MASTER'S THESIS IN TECHNO-ANTHROPOLOGY
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HOW TO MAKE THE IMPOSSIBLE, POSSIBLE

FACILITATING A SHARED HEALTHCARE SYSTEM BASED ON USER PERSPECTIVES

MSc Master of Science in Techno-Anthropology

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This Master's thesis revolves around data availability and sharing across the Danish healthcare setting in relation to electronic medical records. The study contains empirical data generated with ethnographic methods by performing observations of - and interviews with - actors from the three Danish out-of-hours healthcare services i.e. Emergency Medical Service, Emergency Department, and Out-Of-Hours General Practitioner as well as interviews with IT relevant individuals. For analysing data, we have developed an analytical framework (UTOPIA) with inspiration from grounded theory with the purpose of understanding the processes in the setting. We have preliminary interpreted electronic medical records to be boundary objects which will be discussed in the thesis. Moreover, it will be discussed how a potential shared system can facilitate collaboration and avoid information-overload of patient data.

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By signing this document both group members confirm having participated equally in the project and are collectively responsible for the contents of this report. Furthermore, both members assert that plagiarism is not present in this report.

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Abstract

This student report summarises a Techno-Anthropological Master's thesis with focus upon data availability and sharing across the three Danish out-of-hours healthcare services. The research is undertaken in collaboration with Center for Prehospital and Emergency Research. We aimed to study how patient data availability is experienced, and how potential sharing of patient data is described among healthcare clinicians working in the three Danish out-of-hours healthcare services as well as IT relevant individuals. In the study, we employ a qualitative approach and take a methodological standpoint in ethnographic methods by performing participatory observations and carry out semi-structured interviews. For analysing empirical data, we will take inspiration from Grounded Theory and develop an analytical framework. Furthermore, we will use the concept of boundary objects as preliminary interpretation of electronic medical records. In the report we conclude that the healthcare clinicians working in the three Danish out-of-hours healthcare services experience the current patient data availability to be sufficient, yet with room for improvement. Potentially sharing patient data across healthcare settings is described to require arrangement of data that involve aggregated, structured, and standardized patient data, hence avoiding information-overload.

Reading guidance

The content of this thesis consist of empirical data from the three Danish out-of-hours health care service settings i.e. Emergency Medical Service (EMS), Emergency Department (ED), and Out-Of-Hours General Practice (OOH-GP), as well as two prominent actors working within digitalization and IT industry in the North Denmark Region, and the Danish Health Data Authority. We have performed 64-hours of observations in both EMS and ED and held interviews with three OOH-GPs - all of/with actors from the North Denmark Region, Denmark. We have chosen to combine the data generated from all settings, in order to contribute with knowledge to an - at the moment limited scientific area - on data access/data sharing across the three settings.

We will introduce clarifications regarding abbreviations we will use in this thesis - see table below.

Ambulance Professionals	In this study, these are ambulance assistants, paramedics, and paramedics with special competencies.
CPER	Center for Prehospital and Emergency Research.
ED	Emergency Department.
ED Clinicians	In this study, these are doctors, medical students, nurses, nurse students, and secretaries.
EMCC	Emergency Medical Call Centre.
EMR	Electronic Medical Records.
EMS	Emergency Medical Services.
ePMR	electronic Prehospital Medical Record.
GP	General Practice/General Practitioner.
OOH-GP	Out-Of-Hours General Practitioners/ Out-Of-Hours General Practice.
The Core	The center of/point of assembly in an ED.

Quotations from interviews and fieldnotes will be highlighted/enclosed with “quotation marks”. The interviews were translated from Danish to English by us.

Table of content

1.0 Introduction

In this thesis the primary focus is patient data availability and data sharing across healthcare settings. The demand of sharing patient records across healthcare settings has increased throughout the previous decades. Consequently, transitioning from applying paper medical records to implementing Electronic Medical Records (EMR) proceeded in Denmark in the late nineties (Nøhr et al., 2019). By implementing EMRs in Danish hospitals, it was recognized that workflow in-hospital were optimized, and the efficiency of resources were enhanced (ibid.).

The hospital bed numbers are currently decreasing in the Danish Hospitals, which emphasizes the importance of correct referral to treatment and hospitalization of patients (Højgaard and Kjellberg, 2017). In relation to this, healthcare clinicians working in out-of-hours healthcare services i.e. healthcare providers within Emergency Medical Services (EMS), clinicians working in Emergency Departments (ED), and within Out-Of-Hours General Practice (OOH-GP), have been identified as prominent gatekeepers for citizens to enter healthcare services in Denmark (Huibers et al., 2014). The healthcare clinicians within the three mentioned out-of-hours healthcare services is crucial towards correct referral to in-hospital treatment, as they potentially can decompress the number of patients being hospitalized. Healthcare clinicians providing out-of-hours medical care are supported by and utilize EMRs in their work just as healthcare professionals working in-hospital. EMS- and ED clinicians are utilizing the same EMR system. Whereas the OOH-GPs are applying a different system, and this causes limitations in relation of patient data sharing, across the three out-of-hours healthcare settings.

All over the world - including Denmark - various societal challenges in relation to providing patient care have been identified (OECD, 2020; Højgaard and Kjellberg, 2017). The challenges consist of an increasing number of elderly citizens who require treatment as well as an increasing number of citizens diagnosed with chronic diseases (Højgaard and Kjellberg, 2017). The increasing number of patients with more complicated conditions, combined with the desire of digitizing the healthcare sector also bring challenges in relation to information-overload (ibid.).

In relation to the presented societal challenges, data availability, patient data sharing through EMRs across healthcare settings, and the prominent role of healthcare clinicians providing out-of-hours healthcare service - we find it intriguingly interesting to study how patient data is shared across the settings of the three Danish out-of-hours healthcare services as well as whether the healthcare clinicians desire greater access and sharing of patient data in relation to coping with the societal challenges Denmark is facing.

2.0 Analysis of the Problem

In this section, we problematize paper medical records and elaborate on reasons to implement EMR both in-hospital and out-of-hospital in Denmark. Subsequently, we introduce the field of emergency medicine together with the context of this thesis: the three Danish out-of-hours healthcare services. We furthermore describe the EMRs utilized within the three Danish out-of-hours healthcare services as well as how they are technologically connected. With this basis, we problematize societal challenges in relation to the Danish population and digitalization in healthcare settings.

2.1 Historical Context of Electronic Medical Records in Denmark

There is no straight and distinct representation regarding the background of EMRs in Denmark. However, to a certain degree, previous literature has presented history and key dates for EMRs in the Danish context, upon which we base our perspective on EMRs in Denmark. In this section, we will first describe the transition from Paper Medical Records to Electronic Medical Records, then introduce the three Danish out-of-hours healthcare services, and finally present the societal challenges in Danish out-of-hours healthcare services. This will lead to the formation of this master thesis's problem statement.

2.1.1 Planning the Digitization of the Danish Healthcare Sector

Denmark's first hospital was established in Copenhagen, more than 250 years ago. Since then, doctors, nurses, and other healthcare clinicians have taken precise notes on patients' health conditions and have written measurements on paper (Nøhr et al., 2019). Different challenges related to the use of paper documents were identified: they took up a lot of physical space in hospital wards and basements, it was time consuming to search for patients' medical records as well as file paper documents, and this work required a lot of human resources. These paper documents were later labeled paper medical records (ibid.).

Figure 1: Example of a paper medical record from an emergency department (Zhang et al., 2013).

During the 1970s, information technology (IT) systems entered Denmark's hospitals, and by 1982 there were supposedly 32 different IT systems being used in Danish hospitals (Nøhr et al., 2019). In 1995, a plan for the radical digitization of the Danish healthcare sector was created. It embedded a concentrated effort to implement technological solutions in relation to relieve some of the human resources used while filing paper medical records, along with the complexity of hospital documentation (ibid.). One problem was accessibility, as the paper medical records could be required in two hospital wards but could only be physically present in one ward at time.

Furthermore, other identified challenges included the actual treatment performed on a patient, given the readability of some handwritten paper medical records (ibid.). These challenges, amongst others,

and the appearance of IT systems marked the starting point for the implementation of EMRs as standard documentation in Danish hospitals.

2.1.2 Implementation of In-Hospital Electronic Medical Records

In the 1990s, Denmark had a total of 142 public hospitals across 14 counties. EMRs were gaining ground during this period, but they were implemented sporadically across counties (Warfvinge, 2007; Jest & Tynan, 2019). In the 1990s, Funen County implemented an EMR called "MedEx," later recognized as the pioneer of EMRs in Danish hospitals (Jest & Tynan, 2019). The layout and structure were built on the design of old paper medical records, as seen in Figure 2.

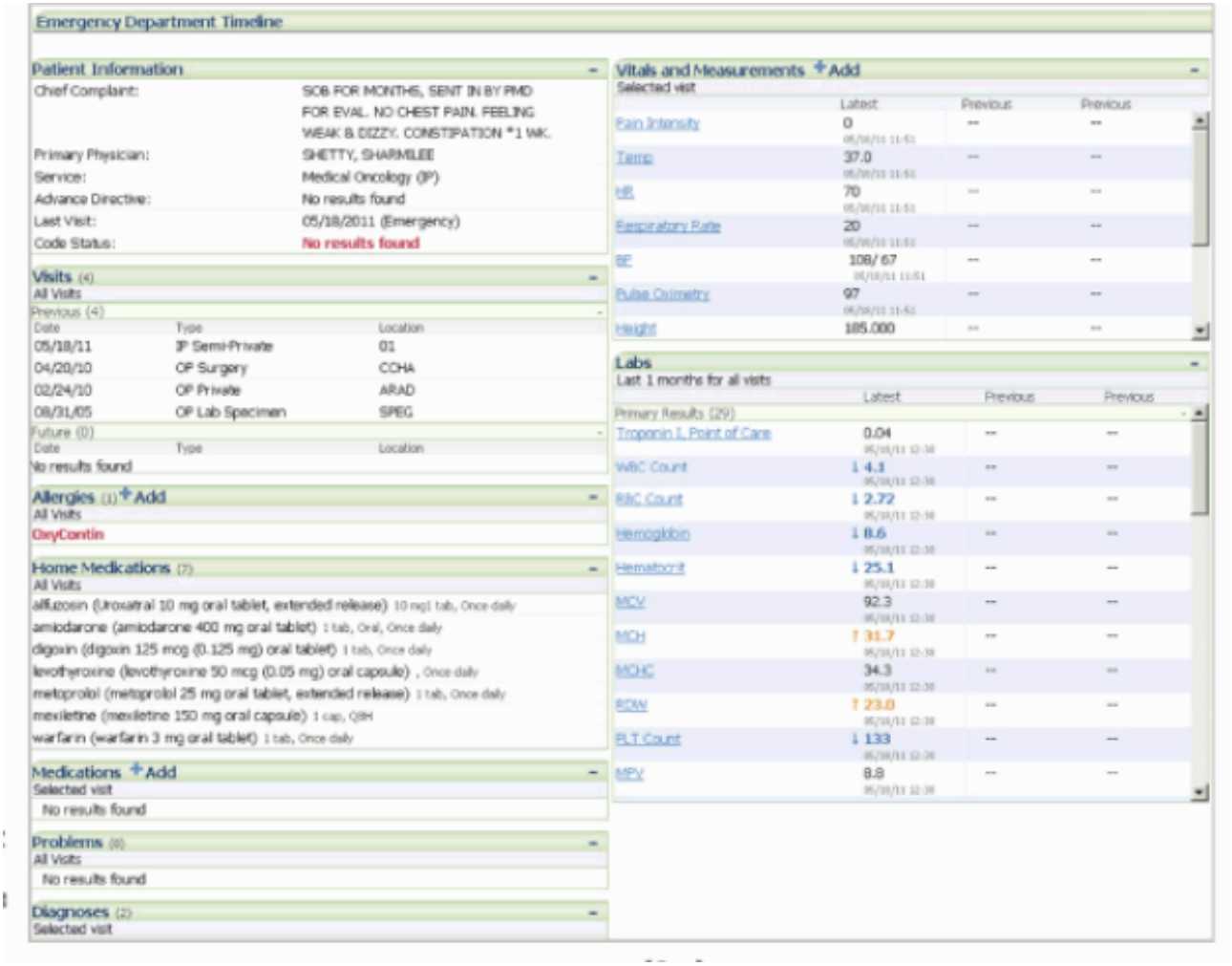


Figure 2: Example of an electronic medical record (Zhang et al., 2013).

Many doctors expressed scepticism towards the new EMRs, while nurses were eager to embrace the changes from the beginning (Jest and Tynan, 2019). Because of the nurses' appreciation, a module for documenting nursing care was developed in 1994 and became immediately operational. In 1999, an EMR system called "Medicare" was implemented using a department-based model, meaning that there was one server per department. Nonetheless, healthcare professionals could access and read the EMRs from the other departments, which was extraordinary at the time (ibid.). Jumping ahead to 2007, the 14 counties referenced above were subject to structural reform in Denmark, which established five regions, replacing the counties. Funen County became a part of the Region of Southern Denmark. An important goal was to have the same EMR in every hospital in the Region (ibid.) In 2011, all of what was once Funen County had successfully implemented and was using the same EMR system called "COSMIC." By 2015, all of the hospitals in the Region of Southern Denmark were using the same EMR system. Future plans included implementing the IT system "EMR South" (EPJ Syd) during the year 2020 (ibid.).

Before fusing the 14 counties, in 1994 North Denmark County, the setting of our thesis, implemented the first EMR called "Treatment and Care System" in just one hospital. This system was later implemented in the majority of rural hospitals and in 1997 it was finally implemented in the county's largest hospital (Aalborg University Hospital), located in an urban area (Warfvinge, 2007). Under the 2007 structural reform, North Denmark County became a part of the North Denmark Region. As of 2015, the EMR in the North Denmark Region was considered to be interdisciplinary and had to follow the national strategy for regulations presented by the Ministry of Health (Niebuhr, 2015; Ministry of Health, 2018). Some of legislation's elements are:

> "[...] *records indicate the patient's condition, planned and performed treatment, etc., including what information has been provided and what the patient has indicated on that basis. Records that contain information about purely private matters and other confidential information about the patient are also part of the overall medical record*." (Ministry of Health, §2, 2018).

Moreover, the legislation emphasizes patient safety regarding documentation and ensures continuity in patient treatment in cases where the in-hospital EMRs' interdisciplinary function comes into play (ibid.). Medical records play a vital part in communicating patient condition and treatment plans

between healthcare professionals. However, it is important to take into account that EMRs are not solely used in-hospital. They have additionally been adopted in out-of-hospital contexts, for example in primary and prehospital care.

2.1.3 The Lighthouse Project

This section focuses on an interview with a project manager for the first out-of-hospital EMR and his experiences with the development and implementation of the electronic Prehospital Medical Record (ePMR). The ePMR is used for documentation by the Danish EMS, which includes ambulances and rapid response vehicles carrying first responders, as well as mobile emergency care units (Lindskou et al., 2019).

In the beginning of the 2000s, "The Lighthouse Project" was launched with the purpose of receiving contractors' contributions and suggestions on how to digitize the prehospital emergency effort in Denmark by combining and enhancing mobile communications and health technology. A private contractor from Denmark won the project bid and started to test its IT system – amPHI. The system was tested in a rural area of the North Denmark Region as a pilot project. A noteworthy element of the amPHI was how it made possible for emergency healthcare professionals to create only *one* combined medical record per patient.

Figure 3: Visualization of electronic Prehospital Medical Record (ePMR) on a mobile tablet computer (Author's creation).

In 2006, the first version of amPHI was implemented in the North Denmark Region and in 2015 the amPHI – hereafter referred to as the ePMR – was installed for use in all Danish ambulances. The ePMR is located on mobile tablet computers in EMS vehicles and are wirelessly connected to a server for data synchronization. The ePMR can withstand losing connection to the server by logging data when the server reconnects. This data redundancy is of high priority, as EMS professionals can find themselves in locations with poor to no network availability.

Authorized healthcare professionals are required to document patient information, condition, treatment, and more (Ministry of Health, 2018). This requirement is applicable for healthcare professionals working in both in-hospital and out-of-hospital settings. The aforementioned history of EMRs, both in-hospital and out-of-hospital, provides the foundation for the current IT systems used to document patient information and referrals of Danish citizens in both contexts. Citizens as well as residents entering the Danish healthcare system are required to follow certain pathways, and Danes who are acutely somatic, injured, or ill after hours (that is, in a moment not part of the working hours of general practitioners (GPs)), have three options to access the healthcare sector: 1) EMS; 2) ED; and 3: Out-of-Hours Primary Care (Lindskou et al., 2019). It is central to this document to introduce the three out-of-hours healthcare services, the IT systems they use, as well as how they are connected technologically.

2.2 Emergency Healthcare Services after Hours

Emergency patients account for the greater part of all hospital admissions. In 2015, of 5.66 million citizens in Denmark, approximately 1.3 million had contact with an emergency out-of-hours healthcare service (Mackenhauer, 2017). The three overall options for contacting and entering the after hours Danish healthcare services are presented below.

The first of the three options is out-of-hours primary care, through which patients can contact GP cooperatives outside of office hours, i.e. between 4 p.m. to 8 a.m. In Denmark, two options for out-of-hours primary care are available: 1) an OOH-GP; and 2) Medical Helpline 1813, which is only available in Denmark's Capital Region (Lindskou et al., 2019; Søvsø et al., 2019). OOH-GP is available for patients to contact after hours when in need of medical assistance to attend to less urgent health problems (Lindskou et al., 2019). OOH-GP assess patients by telephone, consultation, or home-based consultation in the case that a patient cannot wait until the patient's own GP opens the

next day (ibid.). In this thesis, out-of-hours primary care will solely include OOH-GP, the only available in the North Denmark Region.

The second option presented is the Danish EMS, which is available 24 hours a day. Patients who are acutely injured, ill, or are experiencing a life-threatening situation or condition can call the Danish emergency number 1-1-2 (Christensen, 2017). When a patient calls this emergency number regarding health issues or injuries, police authorities will receive the call and forward the call to a healthcare professional working in a Emergency Medical Call Center (EMCC) (ibid.). In the EMCC they assess the severity of the situation and the patient's condition over the phone and then refer the proper EMS vehicle to the location (ibid.). EMS units include ambulances, which are the foundation for the prehospital setting, mobile emergency care units, rapid response vehicles carrying first responders, and helicopter emergency medical services equipped with prehospital doctors (Lindskou et al., 2019). Available supplemental treatment opportunities consist of emergency vehicles equipped with either a paramedic, a paramedic with special competencies, and/or a nurse anaesthetist (Christensen, 2017). *From this point on, we will define EMS as solely encompassing ambulances.*

The third opportunity is the ED, which is also available 24 hours a day. Nonetheless, access to EDs require prior referral from either an OOH-GP or the Danish emergency number 1-1-2 (Lindskou et al., 2019). However, Danish citizens have the possibility of physically going to the ED, yet they are encouraged to contact an out-of-hours healthcare service prior to seeking admission for treatment in the ED (ibid.).

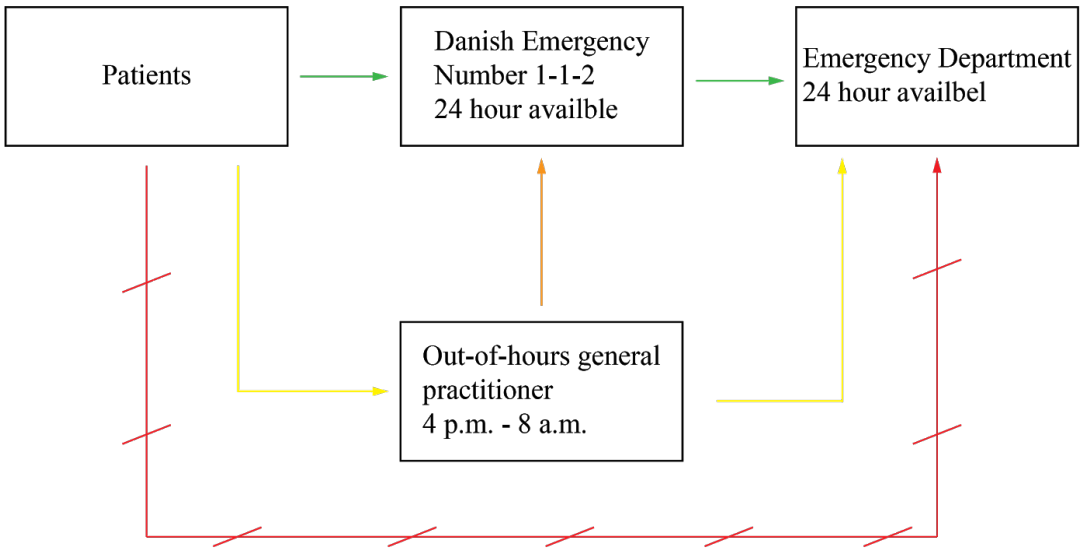


Figure 4: Danish healthcare services after hours. Authors creation - with inspiration from Lindskou et al. (2019).

In the following sections, we will unfold the three out-of-hours healthcare services in emergency medicine. This will clarify which IT systems are being utilized in these healthcare services and how data is made available and shareable among them.

2.2.1 Documentation in Out-Of-Hours General Practice

In Denmark, two out of the three out-of-hours healthcare services (the OOH-GPs and the EMS) use telephones to triage patients and ensure that they receive the right type help at the right time (Søvsø et al., 2019). Patients are encouraged to contact an OOH-GP in less urgent situations that cannot wait until the patient's own GP opens. On the other hand, patients should contact the EMS in life-threatening situations or with limb-threatening issues (Søvsø et al., 2019). The OOH-GPs are available from 4:00 pm to 8.00 am on weekends and on official Danish holidays. The OOH-GPs are run by GPs specialized in general medicine (PLO and the North Denmark Region, 2020).

The General Practitioners Organization (PLO) is responsible for coordinating the OOH-GP. As of March 1, 2020, a new OOH-GP agreement has been put into action with the purpose of:

> "*The agreement aims to ensure that the OOH-GPs can be operated safely and efficiently and addresses the following themes: The OOH-GPs as part of the emergency out-of-hours healthcare services (continuous patient care), an attractive workplace (recruitment and work environment), the right patients, increased quality, and digitalization*." (PLO and the North Denmark Region, p.1, 2020).

The IT system utilized by the OOH-GP must comply with the above written purpose as well as be capable of supporting good patient care progress. In the North Denmark Region, a private company called EG A/S is contracting an IT system named MedWin for use by the OOH-GP. One of the product owners of MedWin agreed to enlighten us on the software's technical aspects in relation to OOH-GP data. This discussion informed the information contained in the following section.

In four out of five of Denmark's regions, MedWin is the IT system that supports the OOH-GPs work practices. Through MedWin, OOH-GPs can access patient-relevant data such as the Common Medicine Card (Fælles Medicinkort – FMK), in order to review a patient's medicine and vaccinations

(Danish Health Data Authority, 2019). It is not possible for OOH-GPs to access medical records from the patient's personal GP, meaning that patient history is limited for an OOH-GP. Whenever a patient completes a consultation, the OOH-GP sends that patient's medical information to his or her personal GP by filling out a discharge summary with notes. The personal GP can then read this information to determine why the patient addressed the OOH-GP and the type of patient consultation practiced. The purpose of this discharge summary is to ensure continuous patient care progress across the Danish healthcare system. Furthermore, it is also possible for the OOH-GP to send information to the Danish Health Authority on a patient's symptoms, which can/will be used for statistics and other general data. If the patient needs to be transferred to a hospital, the OOH-GP will make a referral which automatically transmits any notes documented earlier by the OOH-GP. The product owner also recounts how one can access external healthcare platforms that also contain patient information, e.g. the Healthcare Record (Sundhedsjournalen), but to her knowledge only a very small group of OOH-GPs do so (Healthcare record, 2020).

2.2.2 Emergency Medical Services

In the North Denmark Region, the IT system used to support work performance in EMS is the ePMR (The North Denmark Region, 2019). The implementation and use of ePMRs allowed a more effective and faster flow of this information from the scene of injury to the ED (ibid.). Before referring an EMS to a patient, clinicians at the EMCC will carry out a triage assessment (Lindskou et al., 2019). To do so, they have a support tool called the Danish Index to use as guide for choosing the proper and necessary EMS (ibid.). The Danish Index contains five urgency levels – A to E (Figure 5), where a patient falling within urgency level A is considered an acute or life-threatened patient (ibid.).

A - Acute	Acute situation assessed as potentially life threatening
B - Urgent	Urgent situation but not assessed as acute life threatening
C - Scheduled	Non-acute situations, but with need for observation and treatment in ambulance
D - Supine transport	Transportation while lying down, without need for observation or treatment
E - Other services	Other help such as taxi, directing to other healthcare services, advice, etc.

Figure 5: The five urgency levels in Denmark - From A to E (Lindskou et al., 2019).

In the field, EMS healthcare professionals have a mobile tablet computer (the hardware portion of the aforementioned ePMR system), on which they can assess, comment, document, take notes, etc. When driving to the scene of an injury, the name, address, and triage assessment performed by the EMCC are visible on the tablet. After picking up the patient in an ambulance, the ambulance professional will document answers for predefined modules such as triage and pain assessment (see Figure 3). Some elements within this documentation is simultaneously shared with the healthcare clinicians in the ED so that they can follow the patient's condition and read the latest triage performed by the ambulance professionals when logging onto the central ePMR in the ED.

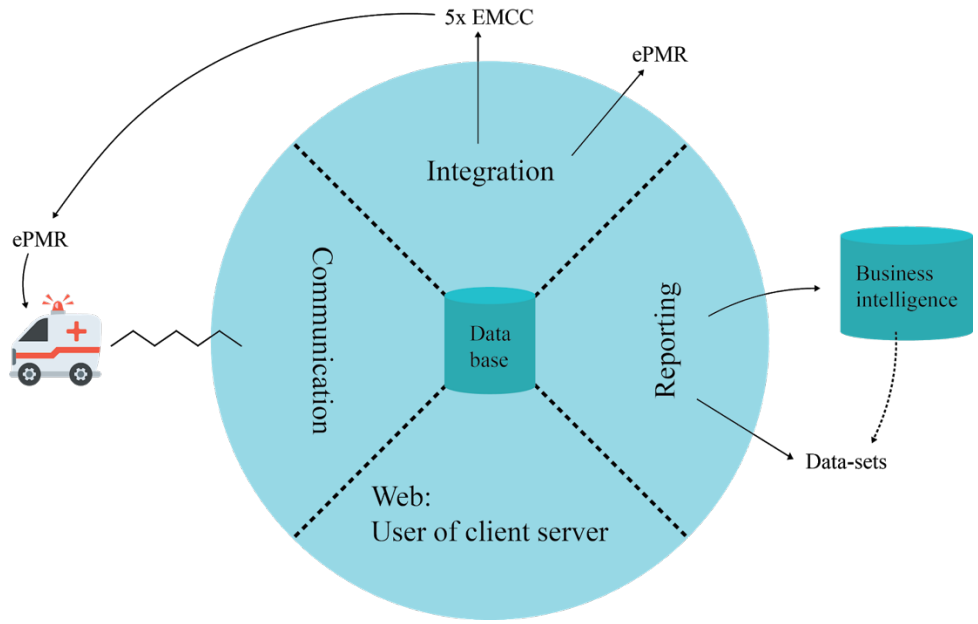


Figure 6: Illustration of the electronic Prehospital Medical Record (ePMR) system (Authors creation).

The previously mentioned project manager explained the ePMR as illustrated in Figure 6. The ePMR is based on client-server architecture with its database located in the North Denmark Region. The use of a client server makes it possible for healthcare clinicians to follow a patient's vital signs until his or her arrival to the ED. Integration refers to each of the five Danish regions individual EMCCs, the patient administrative system, and the ePMR. Together, these three make up the communication which is sent out to the EMS vehicles or helicopters. As previously mentioned, this is some of the communication that can be transmitted without having a real-time connection but that will be logged as soon as a connection is recovered. These data are being used for reporting purposes. The starting point of these data facilitate data extractions in each region's own business intelligence system, and therefore perform important research and large-scale studies within the prehospital umbrella.

2.2.3 Medical Records in the Emergency Department

Multiple IT systems are applied in EDs, such as the ePMR, the EMR in-hospital, and more. The ePMR and EMR were presented earlier in this chapter, however their present status been limited thus far. In 2017, there was a positive development of EMR implementation in Danish hospitals. A few years later in 2020, Denmark's national audit agency 'Rigsrevisionen' announced that all hospitals in every region of Denmark, including EDs, are now utilizing EMRs (Rigsrevisionen, 2020). A movement has also garnered presence in the numbers of EMRs integrated in hospitals. In 2007, there were 23 different types of EMRs, in 2020 there are three, and in 2021 they will be reduced to only two (see Figure 7).

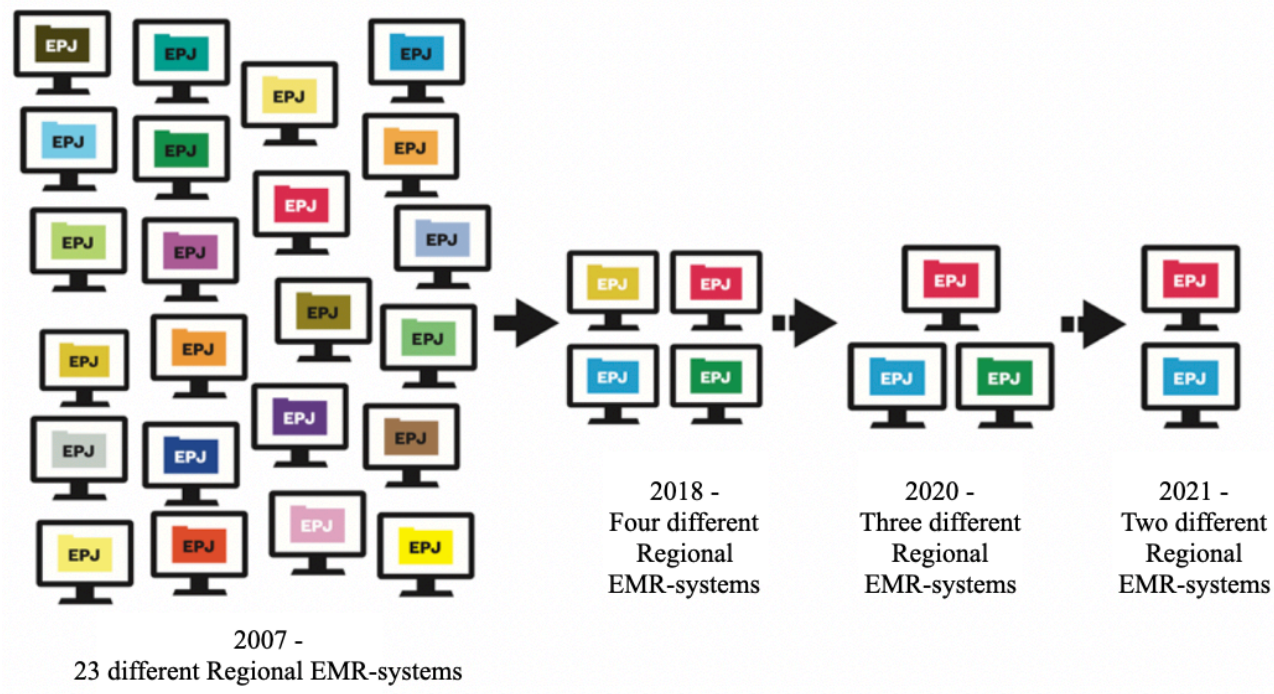


Figure 7: Danish representation of reduction in electronic medical records (Danish Regions, 2018).

In Denmark's EDs, the EMR data are most frequently used to provide information on large screens such as flow screens, which show a review of specific patient information for logistics and as a reference for the nurses and doctors taking care of that patient (Rigsrevisonen, 2020). The main information depicted on the flow screens includes: time of patient arrival to the ED, time the patient was first seen by a doctor, time when triage was performed, the patient's vital signs, where the patient came from, and where the patient is being referred (ibid.).

2.2.4 Shared Data Available Across IT-systems in Out-Of-Hours Healthcare Services

We have now presented how the three Danish out-of-hours healthcare services are organized and use EMRs within these particular settings. This information shows how both the ED and EMS have a shared EMR (the ePMR), which enables healthcare clinicians to share information across settings and prepare for the injured or ill patient. However, the OOH-GP has its own independent system without sharing capabilities with EDs or EMS. The following subsection illustrates how the EMR systems in the three Danish out-of-hours healthcare services are connected.

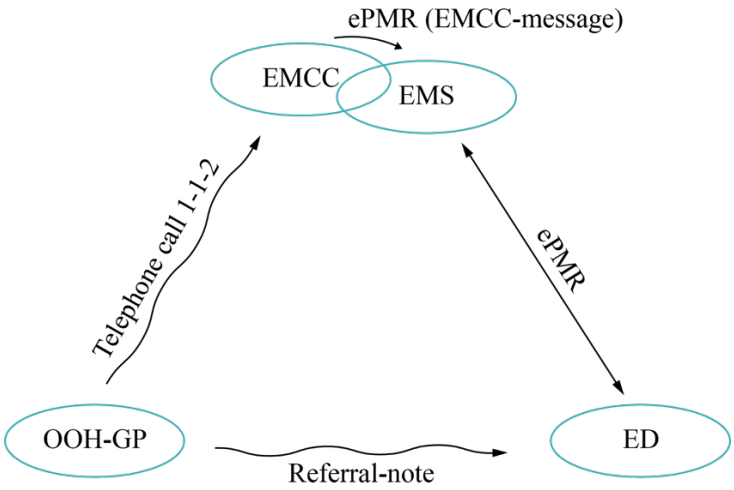


Figure 8: Visualization of the technological connection between electronic medical records in the three Danish out-of-hours healthcare services. The straight line between EMS and ED represents sharing patient data through the ePMR, hence facilitation of collaboration. The waved lines between respectively OOH-GP and ED and between OOH-GP and EMCC represents a one-way communication (Authors creation).

Information sharing between the EMRs in the three Danish out-of-hours healthcare services is illustrated in Figure 8. Information sharing between EMS and ED is facilitated by the ePMR, where EMS share patient information simultaneously with ED. Moreover, ED clinicians are able to send information to the ambulance professionals using a chat in ePMR. The information sharing is restricted to this functionality only i.e. chatting with ambulance professionals. The ED clinicians receive electronic referral-notes containing patient information from OOH-GP. However the ED clinicians cannot convey electronic referrals to OOH-GP, hence OOH-GPs cannot access EMRs that are used in ED. Information sharing from OOH-GP to EMS is not available, however in need of referring a patient by ambulance, the OOH-GP calls the Danish emergency number 1-1-2 by telephone. The information provided through phone from OOH-GP to the EMCC clinicians, is registered in a EMCC-message and are being send electronically to EMS.

2.3 Societal Challenges

Challenges and trends have been identified worldwide - including the Danish healthcare setting (OECD, 2020; Højgaard and Kjellberg, 2017). One challenge is that we will see a change in the population's composition as the number of elderlies will soon increase significantly (ibid.). Figure 9 shows Denmark's population distribution by age groups from 2008 to 2058 (Statistics Denmark, 2018). In 2020 the elderly population is estimated to reach approximately 1,200.000 in a population of just about 5,800,000 (ibid.). This demographic development will result in greater demand of healthcare services, while the tendency of increases in lifespan will potentially add more years of life that require healthcare treatment (Højgaard and Kjellberg, 2017).

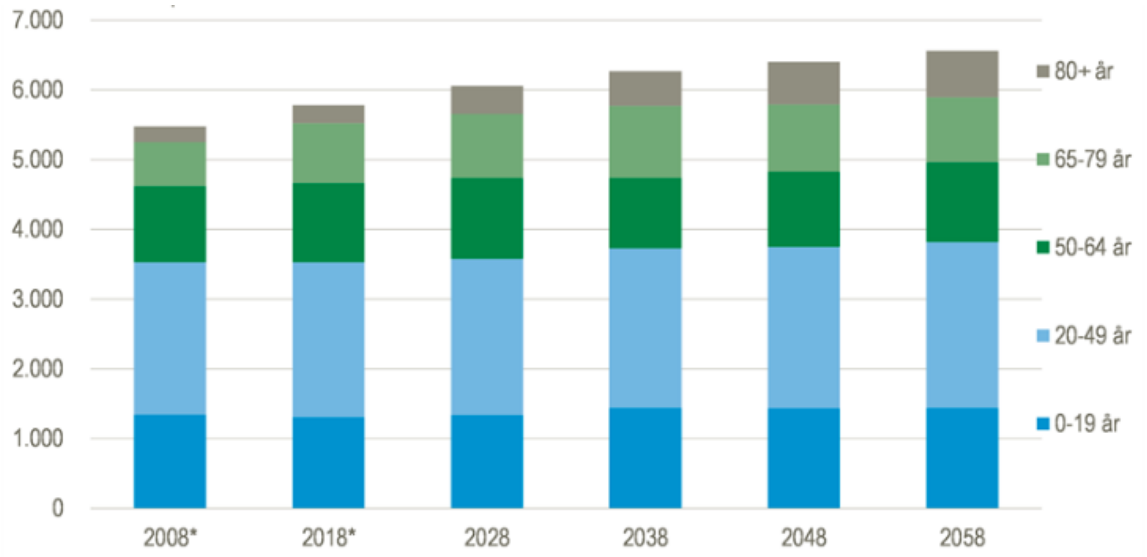


Figure 9: Projection of population growth. The number is specified in thousands (Statistics Denmark, 2018).

Moreover, one third of the Danish population is diagnosed with one or more chronic diseases and this is predicted to increase in the years to come (Højgaard and Kjellberg, 2017). Citizens with chronic diseases are in contact with many different health professionals, and the need for sharing data across the healthcare sector is vital (Danish Regions, 2015). It is essential that the data follows the patient, so that healthcare professionals in municipalities, in primary care, and in hospitals can access relevant patient data and inform themselves on the patient's care progress in order to provide them with the best treatment (ibid.).

Nevertheless, the amount of patient data will surely increase, which will challenge clinicians working in healthcare settings as well as patients as they will experience an information-overload (Højgaard and Kjellberg, 2017). There is potential for digitalization and technology to overtake the public healthcare system, which poses a socio-cultural issue, as citizens with greater resources are better equipped to take advantage of smart solutions outside of the public healthcare system when compared to citizens with few to no resources (ibid.).

In Denmark, the number of hospital beds has decreased in recent years, and for people living in remote areas, the distance to a hospital has become longer. Furthermore, fewer hospitals in Denmark contains EDs and the need for out-of-hours healthcare, for example EMS, is expected to increase (Christensen, 2017). Moreover, OOH-GPs hold an important gatekeeping role to the secondary healthcare sector, including hospitals, in relation to referring solely urgently injured and ill patients directly to EDs (Huibers et al., 2014). With respect to this, we identify a demand for correct referral processes for patients requiring hospitalization by out-of-hours healthcare services. Thus, we identify actors in the three out-of-hours healthcare services as gatekeepers to in-hospital treatment, and as those who could possibly relieve the assumed increased pressure facing Danish hospitals. Additionally, we assume that a strong IT systems infrastructure functioning across the out-of-hours healthcare services will be an important asset in comprehending the societal challenges presented above.

3.0 Problem Statement

The challenges previously presented in relation to EMRs across the Danish out-of-hours healthcare services constitutes the foundation of this thesis. We have introduced how paper medical records became inadequate because of increasing requirements for sharing and accessing medical records across in-hospital settings, e.g., between departments, which resulted in the implementation of EMRs. Furthermore, the amount of patient data will likely increase in the future, which could cause an information-overload for healthcare clinicians. Therefore, we have identified a greater demand for sharing patient data across healthcare settings. We have discussed how the EMS and EDs are sharing patient data through the ePMR, yet also how data sharing across the three Danish out-of-hours healthcare services is somewhat restricted, and at times, unavailable (see Figure 8). With this knowledge, we make the preliminary assumption that the actors in the three Danish out-of-hours healthcare system could benefit from more data access and data availability in order to carry out patient treatment. Thus, this master's thesis aims to answer the following problem statement:

> *How do healthcare clinicians working in the three out-of-hours healthcare services experience current patient data availability as well as describe potential sharing of patient data across healthcare settings?*

4.0 Literature Review

To answer our problem statement, we find it vital to investigate academic and scientific research regarding data availability in the field of emergency medicine and primary care. To do so, we have conducted systematic searches in the following journals: the Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, Family Practice (Oxford Academic), BMJ Open Quality, BMC Family Practice, Scandinavian Journal of Primary Healthcare, and the British Journal of Family Practice. Below we will reveal and discuss relevant literature that relates to our research.

4.1 General Practitioners' Role in Emergency Medicine

A study performed by Grol et al. (2006) looked into the OOH-GP in the United Kingdom, the Netherlands, and Denmark. They investigated the transition from individual and group practices with local after-hours services to large-scale after-hours services (ibid.). They discuss a 1992 change in the system, when Denmark went from local groups of GPs who performed after-hours care services to large organizations handling after-hours care services, which reflects the current system in Denmark (ibid.). It was found that the transition reduced the GPs' workload and that the number of clinicians working 10 hours or more per week in after-hours care decreased by 40% over three years (ibid.). Hence, it can be said that the transition was beneficial for the Danish OOH-GPs. As part of the field of emergency medicine, Danish OOH-GPs have been well-studied in comparison to other countries such as Norway and the Netherlands (Huibers et al., 2014; Grol et al., 2006).

A study by Hjortdahl et al. (2018) performed in Norway examines GPs' perception of their role in emergency medicine. The authors found that the GPs identified themselves as playing an important role in emergency medicine, and that they were a part of providing after-hours care services related to prehospital emergencies (ibid.). Lindskou et al. (2019) have presented how the out-of-hours healthcare services are organized in Denmark, however, this does not include the perspectives of GPs. The study accounted for OOH-GPs as a contact option for Danish citizens and that they take part in minor health problems or less urgent injuries, either by assessing the patient by phone, home-based consultation, or consultation, or providing a direct referral to the hospital (ibid.). In a study carried out by Huibers et al. (2014), it was found that Danish and Dutch GPs act as gatekeepers to hospitals. This study furthermore presents comparable healthcare settings and found that the work practice of Danish GPs is influenced by the fee-for-service system, meaning that expenses are financed through

taxes, which potentially affects the GPs performance of after-hours care services (ibid.). We find it relevant in this thesis to contribute with knowledge regarding how OOH-GPs experience their role in Denmark's emergency medicine system and present an extended outline of their work.

4.2 Emergency Medical Records as an Object of Research

In Denmark, IT systems were implemented in hospitals during the 1970s, yet the first electronic EMR was not employed until the 2000s (Nøhr, et al., 2019). Krogh-Jensen's study (1984) presented that the PLO board accepted the system to realize the digitization of medical records and undertook the economic responsibility for the transfer process from paper to a computer program. Furthermore, the study provides a written depiction of the EMR's 19 components, which became the standard for Danish GPs' records system (ibid.). To our knowledge, there is no existing literature on how the Danish GPs perceive EMRs. However, a Norwegian study by Christensen and Grimsmo (2008) investigated this to see whether the EMR systems have reached their full potential. The study revealed that EMRs were usually considered as successful in GP, yet there was room for improvement (ibid.). GPs pointed to how utilizing the EMRs was time consuming, source oriented, and did not always support decision making, present guidelines, or medical procedures (ibid.). The study suggested that EMRs should be able to support clinical decision making, integrate with other patient records, and provide consultation with specialists, which is associated with increased quality of patient treatment and consultation (ibid.). In relation, we find it interesting to study how the healthcare professionals included in this study experience the data available in the EMRs of the three out-of-hours medical services.

4.2.1 Medical Records in Out-of-Hospital Settings

One EMR that does provide some sort of consultation with specialists is the Danish ePMR. This ePMR allows emergency vehicles share data with emergency clinicians from EDs before arriving at the ED. The ePMR and data generated within it have been well-studied in Denmark (Lindskou et al., 2019; Christensen, 2017; Søvsø et al., 2020; Poulsen et al., 2020). The ePMR is on a tablet located in ambulances and rapid response vehicles. It has been in use since 2006 in the North Denmark Region and nationwide since 2015 (Lindskou et al., 2019; Poulsen et al., 2020). Ambulance professionals are able to document evidence using the ePMR and forward the patient's medical information to a hospital, while simultaneously providing prehospital care (Lindskou et al., 2019).

Furthermore, ePMR use has intended to generate high-quality data on prehospital patients, which holds great potential for research purposes related to the Danish prehospital patient population (ibid.).

A 2007-2017 Danish study carried out by Poulsen et al. (2020) in the North Denmark Region found an increase in the quality of vital signs registered in the Danish ePMR. Additionally, it was found that the implementation of the new, nationwide version of the ePMR in 2015 caused a decrease in quality of vital signs as blood pressure, saturation, heart frequency, respiratory frequency, and temperature (ibid.). However, the quality improved again over the following years (ibid.). The study concluded that the high level of registration competencies by the ambulance professionals resulted in higher quality in the vital signs registered (ibid.). No other Danish study has looked at how ePMR documentation plays a role in emergency medicine. However, a Norwegian study by Staff and Søvik (2011) researched this - but focused on paper medical records. The researchers set out to investigate the quality of prehospital documentation in motor vehicle accidents within nine Norwegian counties (ibid.). The medical records used for documentation were standardized, yet they contained seven different templates. This affected the level of detail reported on patient information and vital signs (ibid.). Staff and Søvik suggested a uniform template for medical records in ambulances, with specific guidelines and field definitions, as this would reduce the differences in the documentation. Overall, the study concluded that having a uniform template should cause a higher level of quality documentation, which could benefit clinical audits (ibid.). In relation, it is important to note that the Danish ePMR consists of a nationwide united template (Lindskou et al., 2019). Some literature within emergency medicine has investigated how available information can play a role in clinical reasoning within prehospital settings (Andersson et al., 2019; Norri-Sederholm et al., 2015). Clinical reasoning happens even before arriving to the injury site, based on the information EMS providers receive from the EMCC (Andersson et al., 2019). The information received from the EMCC and other sources helps to create a holistic overview of the injured or ill patient (ibid.).

The recognition of EMRs as support tools for multiple GP practices, together with our focus on emergency medicine and the three Danish out-of-hours healthcare services, makes it even more intriguing to research how EMRs support the work of OOH-GPs, EMS clinicians, and ED clinicians. Moreover, no studies have investigated how the Danish ePMR employed in ambulances affects the collaboration between the EMS and ED – how the ePMR enables patient information to travel from the scene of the injury to the ED even before the ambulance arrives at the ED. In relation, we find it

relevant to contribute to the field of emergency medicine by researching whether access to more data (similar to that provided by the ePMR to ED clinicians), can be beneficial for clinical reasoning in the context of the three Danish out-of-hours healthcare services.

4.3 Handover in Emergency Settings

Collaborative efforts and the handover of patients between the EMS and ED are well documented (Owen et al., 2009; Knutsen and Fredriksen, 2013; Shelton and Sinclair, 2016). Denmark implemented a geographical information system that provides an estimated arrival time for incoming patients from the EMS to the ED in 2014 (Raaber et al., 2016). This study by Raaber et al. analysed how Danish ED nurses perceived the system in terms of wait times and workflow (ibid.). The consensus was that ED coordinating nurses perceived the system positively, highlighting the optimization of workflow with highly accurate information, as well as suitable estimates of EMS's arrival time (ibid.). The study also looked at the effect of the geographical information system as related to timing the activation of ED staff such as emergency medical teams and trauma teams, in situations where patients are in life-threatening circumstances (ibid.). Ways to efficiently and accurately handover patients to the ED in a standard manner have been studied in other countries as well (Harmsen et al., 2017; Shelton and Sinclair, 2016). A Canadian intervention study by Shelton and Sinclair (2016) researched whether strategies like education and the introduction of electronic dashboards for patients arriving at the ED could improve use of EMS reports within the ED. It was found that unused clinical EMS information in EDs is sometimes due to EDs that lack a system to distribute EMS reports electronically and simultaneously (ibid.). Also, EDs that do have such systems experience delays in processing the EMS information, hence reports are unavailable to ED clinicians before patient arrival (ibid.).

To our knowledge, there is no research concerning how the ePMR information available in Danish EDs is described and used by Danish ED clinicians. Therefore, in the Danish context it is relevant to research how information sharing through the ePMR and how handovers between the EMS and the ED may affect work practices within these settings. Other studies have investigated how verbal and written handovers, i.e. using paper medical records, has been described by ED clinicians (Knutsen and Fredriksen, 2013; Owen et al., 2009; Fitzpatrick et al., 2018; Sujan et al., 2013). In a Norwegian study by Knutsen and Fredriksen (2013), it was found that ED clinicians preferred verbal handover from EMS professionals over written handover, and that half of the written EMS documents were

never transferred or scanned into the hospital records. This was identified as a potential risk for the loss of important information that could result in discontinuity of patient care (ibid). Furthermore, it was found that the ED clinicians appreciated verbal consultations with other physicians and specialists more than the information that was obtained from EMS professionals during verbal handovers (ibid).

An in-depth and detailed handover in the ED is been considered essential in order to increase the quality of care, support decision making, and ensure continuity of care (Hovenkamp et al., 2018). Both verbal and written handovers can be influenced by a lack of active listening among ED clinicians, information-overload, and failure to reach common understanding between ambulance professionals and ED clinicians (Ebben et al., 2015; Hovenkamp et al., 2018; Owen et al., 2009). Few studies have been conducted on handovers and referrals in OOH-GPs. A study by Skelton et al. (2019) found that with an increase in the number of patients with comorbid diagnoses and conditions in OOH-GP, there is a need for standardized electronic handovers to hospital departments after hours. Transparent, structured, and standardized handovers after hours have been associated with fewer mistakes and errors in Out-Of-Hours care (Skelton et al., 2019; Patel and Thiagarajan, 2014). A British intervention study by Ah-Kye and Moore (2015) has further researched how implementing a "traffic light system" affects workplace practices in after-hours care. It was found that the "traffic light system" contributed enhanced efficiency and supplementary structure to the EMR in OOH-care (ibid.). In the light of these studies, we find it important to investigate how the Danish OOH-GPs collaborate across healthcare settings as well as how they describe available information in OOH-GP.

4.4 A Joint System in the Three Out-of-Hours Healthcare Services

Successful electronic information flows in healthcare have been recognized as essential for providing better care within emergency medicine and in primary care (Meaker, 2018; Harmsen et al., 2017). Sharing healthcare data enables the transfer and exchange of clinical and administrative information between different healthcare professionals, organizations, and patients within emergency settings (Meaker, 2018).

It is reasonable to assume that technological artifacts can enhance clinical work practices by providing knowledge and information (Adam et al., 2017). Within the OOH-GP, sharing information after-

hours through electronic anticipatory care plans, e.g. for pain management in OOH-GP, has been found essential in improving continuity of care and collaboration between primary and secondary care providers (ibid.). A British study by Balla et al. (2012) concerning decision making in OOH-GPs identified that a lack of information across healthcare settings, including among OOH-GPs and hospital staff, has been associated with poor decision making. Likewise, they found that feedback to OOH-GPs from collaborative actors, such as GPs during normal office hours, as well as the development of systems to support clinical reflection, could improve clinical decision making in an OOH-GP (ibid.). Other studies have similarly recognized that joint systems, which provide and share patient information, can be beneficial in relation to clinical workflow and patient outcome in OOH-GPs and emergency medicine (Hall et al., 2017; Azarm-Diagle et al., 2015; Raaber et al., 2016; Andersson et al., 2019). For instance, a study conducted by Hall et al. (2017) found that giving OOH-GPs and hospital departments access to an information system that contained patient information collected by their GP, such as information regarding diagnosis, demographics, medical history, and resuscitation status, has the potential to prevent unnecessary hospitalization of patients at the end of their life. However, no studies have been performed in an OOH-GP regarding data sharing across healthcare settings, and we find it relevant to contribute with perspectives on this topic from within a Danish healthcare setting.

Within the research fields of both primary care and emergency medicine, technology plays a great part in assisting decision making, supporting workflow in complex settings, developing united systems, conducting research, and enhancing patient safety. It is noticeable that only few studies in these research fields reflect upon unified systems across the three out-of-hours healthcare services. To our knowledge, no such study has yet been conducted in Denmark. Therefore, it is of great relevance to research whether sharing patient data among the three out-of-hours healthcare services can be beneficial for clinical workflow and practice. Recognizing that the settings of the three out-of-hours healthcare services are complex and broad, in which healthcare professionals take part in collaborative activities, it is interesting to research *how the healthcare professionals working in the three out-of-hours healthcare services experience current patient data availability as well as describe potential data sharing across healthcare settings*. Moreover, countries with healthcare profiles similar to the Danish could potentially benefit from this knowledge.

5.0 Research Design

For this thesis, we have chosen to employ a qualitative approach in relation to studying how clinicians in the three Danish out-of-hours healthcare services experience and describe data availability and access in their particular settings, as well as uncover the restrictions and possibilities that are technologically relevant in relation to EMRs. In particular, we adopted an ethnographic approach with inspiration from works by both Neyland (2008) and Spradley (1980). Using this approach provided an opportunity to uncover situated knowledge and user perspectives (Haraway, 1988). We planned to apply the same methods in the different field sites for generating data throughout this thesis. However, due to the COVID-19 pandemic, we were forced to restructure our research design. Based on this, we planned semi-structured interviews to manage and overcome the new and obscure situation. We employed and were inspired by Tanggaard and Brinkmann's (2015) interview framework and approaches.

5.1 Data Collection and Access to Field Sites

In the following chapter we will unfold how we have gained access to the different field sites and generated the data included in this thesis. While accessing the field sites, we were inspired by Neyland' sensibilities (2008), as well as the perspective on establishing close relationships with both gatekeepers and members of the different field sites included in this study. While generating data we employed aspects from Spradley (1980) related to performing fieldwork and observing different social situations across various locations, actors, and activities (see Figure 10).

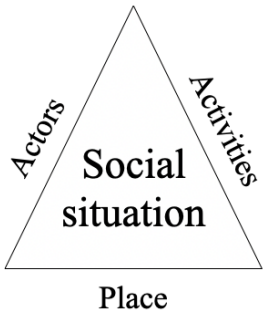


Figure 10: A social situation is constituted by actors, place, and activities (Spradley, 1980).

To take notes in the field, we created a shared template inspired by O'Reilly's (2012) team ethnography. The template included the sections 1) Place and action; 2) Feelings, and 3) Conversations. This template ensured that we would take notes using the same framework, albeit with distinct actors, activities, and conversations with ambulance professionals during our observations. In relation to answering our problem statement, we have chosen to combine data generated within the performed ethnographic fieldwork, i.e. participant observations, from our 8th semester and 9th semester, as well as semi-structured interviews held during our 10th semester. The following sections will elaborate on the

locations we visited, the actors we included in our empirical studies, and how we approached the different fields given differences that occurred in our method regarding data generation during our three semesters.

5.1.1 Ethnography in Ambulances

In spring of 2019, we studied our 8th semester in the Masters in Techno-Anthropology at Aalborg University. Both of us possessed great interest in the healthcare area, as one of us is a registered nurse and the other has worked multiple years in a nursing home. With a basis in our common interest, we decided that we wanted to research something within healthcare. The question was: *what area within healthcare*? And more specifically, what did we want to study? We were given the opportunity to work within the field of prehospital and emergency research. This section will elaborate on our journey – on how we contacted external partners, where we were located, with whom we were involved, and the methodology we used to perform our study. To provide an overview of all our activities in the EMS setting, we have constructed Table 1 that shows the chronological order of all our activities on 8th semester.

Dates	Activities
07.02.2019	Researcher Matching 2.0.
18.02.2019	Meeting with Center for Prehospital and Emergency Research.
26.03.2019	Meeting at Emergency Medical Service – North Denmark Region (Den Præhospitale Virksomhed).
29.03.2019-12.04.2019	Driving along in ambulances and being at the ambulance station in the North Denmark Region.
25.04.2019	Interview with a project manager for the first out-of-hospital Electronic Medical Record.
07.06.2019	Supplementary observations in ambulances.
14.06.2019	Grant of summer scholarship from the North Denmark Region.
20.08.2019	Photography with Center for Prehospital and Emergency Research.

The date format is in British English.

Table 1: Overview of activities performed on 8th semester spring 2019.

We participated in an event called *Research Matching 2.0* in February of 2019, arranged by a union of medical students from Aalborg University. At this event, different departments and research units from hospitals in Aalborg were represented, including oncology departments, medical physics, the Center for Prehospital and Emergency Research, and a Laboratory for Medical Mass Spectrometry. The different departments and units presented one or multiple projects for study. The Center for Prehospital and Emergency Research (CPER) presented itself as a research unit that carries out studies within the prehospital and emergency areas. Furthermore, CPER expressed interest in qualitative research and ethnographic methods, which awoke our curiosity. During the event's break, we approached CPER's two representatives, Morten Søvsø, Ph.D., and Tim Lindskou, Ph.D. We told them how we were interested in a project they had presented related to the use of an ePMR and explained that we could apply our vast experience with qualitative methodology in order to examine the subject. We agreed on sending a follow-up e-mail to the secretary of CPER's research unit.

We arranged a meeting shortly after the event with Morten Søvsø, Tim Lindskou, and Erika Frischknecht Christensen (Unit Leader from CPER). We gained insight into how they performed research, and it became clear that we were counter-directed to their usual approach. We discussed how they normally included large-scale datasets from the ePMR, whereas we mainly relied on in-depth field notes from our observations. This contrast was identified as a point of interest by both CPER and ourselves. Moreover, CPER expressed interest in our competencies as techno-anthropologists, and we agreed on a collaborative study concerning ambulance clinicians' utilization of the ePMR.

However, the qualitative approach combined with the prehospital setting proved to be a challenge, as literature is sparse to non-existent, even more so when including the unique ePMR. Therefore, our contribution would provide important information to CPER's field. The study was therefore identified as a central and novel contribution to scientific knowledge for researchers across the world that showed interest in the Danish prehospital and emergency areas. Almost immediately after our agreement we were introduced to CPER's various external cooperating partners also working with the ePMR, for example Emergency Medical Services - North Denmark Region (Den Præhospitale Virksomhed). Furthermore, Emergency Medical Services - North Denmark Region invited us to a presentation which introduced us to the two ePMRs: A mobile ePMR on a tablet computer and a

central ePMR on a stationary screen. Additionally, the components and modules within the ePMR were introduced during the presentation on the mobile tablet as depicted in Figure 3.

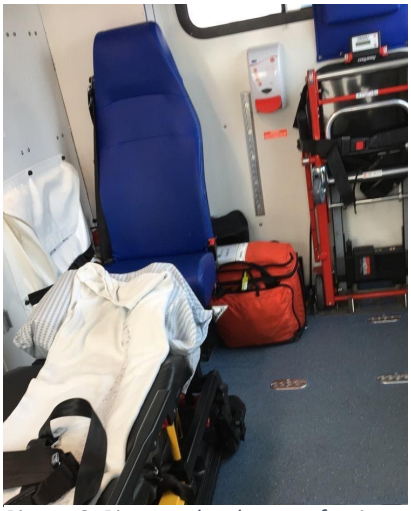
This provided great insight into the central technological processes and the hardware of what we were going to be researching. During our meeting with these external cooperating partners, we briefly presented our thoughts on how we wanted to perform our study on the ambulance professionals' use of the ePMR, and we all agreed that the study should move forward.

We embraced team ethnography as well as Spradley's perspectives on observations. Our study began with a visit to an ambulance station located in an urban area of the North Denmark Region in late March 2019 (O'Reilly, 2012; Spradley, 1980). We were met by the station's operational manager, who introduced us to several healthcare professionals and ambulance professionals working for the EMS, consisting of paramedics, paramedics with special competencies, and prehospital anaesthesiologists. We were assigned to follow ambulance teams in different emergency vehicles. Each ambulance carries two professionals, one to drive the ambulance and the other to treat the patient in the stretcher compartment.

When accompanying the ambulances, we were clothed in safety shoes and a thermal jacket covered by a yellow vest with the word 'observer' (observatør) on the chest and back (see Picture 1). This clothing's purpose was to inform the patient and their relatives that we were not a part of the EMS personnel. When our respective ambulance professionals received a call over the radio from the EMCC, we followed them to the ambulance garage. Here, the ambulance professionals would sit in the front of the ambulance and we would sit in the stretcher compartment. If the ambulance drive was identified as an A-drive (an acute situation assessed as potentially life threatening, see Figure 5), the ambulance professionals would turn on the lights and sirens. When arriving on-scene to a patient, we would leave the ambulance together with the ambulance professionals and approach the patient.

Picture 1: Picture taken by one of us in an ambulance. Showing us wearing a white working jacket with a yellow vest with the text 'observer'.

However, we would stand in the background, with a discrete notepad, and observe how the ambulance professionals utilized the ePMR while being with on-scene with the patient. In this way, we were not obvious to the patient and the ambulance professionals could assess and treat the patient without us interfering in the process. When the patient was brought into the stretcher compartment, we would enter the ambulance and situate ourselves on a seat behind the stretcher, as depicted in Picture 2.



Picture 2: Picture taken by one of us in an ambulance. Showing the stretcher compartment and the seat where we were located while driving to emergency department with patient.

From this location we were able to observe the activities performed by ambulance professionals, the relationship created with the patient, and more. Additionally, the patient could not see us, as they were facing the other direction, so we were not a distraction for either the patient or the ambulance professionals. While the patient was in the ambulance, the ambulance professionals would document information on the ePMR and simultaneously ask the patient questions. However, patient treatment was always the first priority, and, in some life-threatening situations, documentation of information would be postponed until the patient was handed over to an ED. In most cases, the patient would be handed over to an ED and we would continue to follow the ambulance professionals in order to observe how the ePMR was employed when ambulance professionals were handing over a patient.

In total, we observed 42 ambulance runs over a total of 64 hours of participant observation covering day, evening, and night shifts. Twenty-six ambulance professionals are included in this study. Additionally, the performed study resulted in an academic article which has been submitted to the *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* and is currently under evaluation.

Based on Spradley's (1980) perspective, in the above section we have explicitly described our social situation. The physical setting included the ambulance station, the ambulances, and the scenes of illness and injury. Furthermore, the ambulance professionals and the operational manager have been key actors, and the activities we observed have been central for the analysis that we will take on later in this thesis. After finishing our 8th semester and completing our observations in the ambulances, we found it relevant to research how healthcare clinicians working in EDs were using the available and

shared patient information from the ePMR. Therefore, we decided to perform an ethnographic study in EDs during our 9th semester in the fall of 2019.

5.1.2 Observations in an Emergency Department

We continued our collaboration with CPER and during our 9th semester, we became academic interns at the research unit. In our internship we were assigned the task of performing a study on how ED healthcare clinicians utilized the central ePMR on the stationary screen and the available patient information documented by the ambulance professionals. Once again, team ethnography was used, as well as Spradley's perspectives on observations (O'Reilly, 2012; Spradley, 1980). Regarding scientific literature on studies in EDs, we found that studies performed qualitatively and with a focus on user experiences are limited, which became an asset in our case for performing this study on EDs and ePMRs. In Table 2 below, an overview of the activities performed on 9th semester is presented.

Dates	Activities
02.09.2019- 31.12.2019	Academic internship at Center for Prehospital and Emergency Research.
10.09.2019	Research meeting at Center for Prehospital and Emergency Research.
24.09.2019	Research meeting at Center for Prehospital and Emergency Research.
09.10.2019- 10.10.2019	Participating in E-health Observatory (Conference).
07.10.2019- 31.10.2019	Performing observations in an Emergency Department in the North Denmark Region. Participating in Center for Prehospital and Emergency Researchs Symposium.
07.11.2019	Research meeting at Center for Prehospital and Emergency Research.

The date format is in British English.

Table 2: Overview of activities performed on 9th semester fall 2019.

First, we contacted the ED's head nurse and we were granted permission to perform the study. We positioned ourselves in the largest urban ED in the North Denmark Region. Here, we were introduced to some of the many actors working in ED, including nurses, doctors, medical students, nursing students, and secretaries. Just as in our ambulance study, we carried out 64 hours of observations throughout day, evening, and night shifts in the ED. The ED was a complex setting, as patients were located in many different places and many activities happened at once. We decided to start by observing the central ePMR, which was physically located on a stationary screen on the counter in the Core, in the middle of the ED as illustrated in Figure 11. The Core was quickly identified as the main part of the ED, where information screens such as electronic whiteboards (known as Cetrea-screens) and the ePMR were located. Furthermore, it was where the nurses and doctors would gather to communicate and gain an overview of assigned patients and patient flow. When ambulance professionals handed over a patient to the ED, they addressed a coordinating nurse in the Core as well.

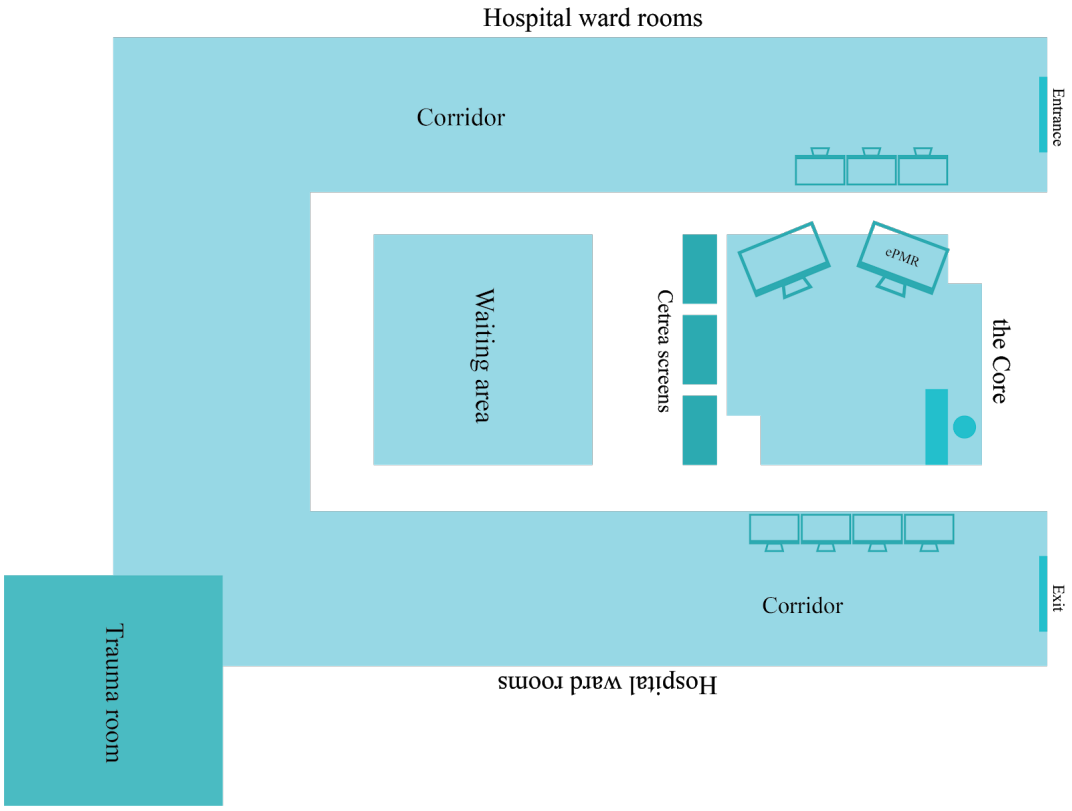


Figure 11: Illustration of the Core in the observed emergency department in the North Denmark Region (Authors creation).

We used the same template as when taking notes in the field, including the sections: 1) Place and action; 2) Feelings; and 3) Conversations (O'Reilly, 2012). We were clothed in a white working coat and carried a key-hanger around our necks with ID cards containing our names and information (our titles: students from the Techno-Anthropology department at Aalborg University – see Picture 3). We were not fully dressed in hospital clothes in order to emphasize our role as outsiders for the patients, their relatives, and hospital clinicians. Furthermore, it was a way of distancing ourselves from the staff working at the time, although using the white working coat was still a way for us to blend in.

Picture 3: A picture of us wearing white coats while performing observations in the emergency department.

We applied different techniques to observe the use of ePMR in the ED. As mentioned, we started by standing and observing the ePMR screen in the Core area. This was done to gain insight into the activities taking place in the Core, as well as to create relationships with different ED clinicians, with whom we would later walk and observe.
A while into our observations, we decided to split up. One of us would stand in the Core, and the other would walk with either a nurse or doctor. Standing in the Core made it possible for us to observe the patient overviews displayed on the ePMR screen for those arriving with the EMS (Figure 12). The information displayed included the patient's name and admission address along with a message from the EMCC about when the patient or relative called the emergency number 1-1-2, the primary and current triage situations, and much more.

Info	Date	Name of patient	Social security number	Admitting address	EMCC message	Receiving unit	ETA	Triage		Type of run		EMS vehicle	EMS vehicle telephone number
								Primary	Current	Out	Return		
	09.11.19	Anders Andersen	098765-4321	Andvej 1	Dyspnoea, chest pain, has been passed out	Aalborg University Hospital, Emergency- and Trauma Centre	11.45			A	A	3-3092	20202020

Figure 12: The overview from the electronic Prehospital Medical Record (ePMR) visualized as presented on the stationary screen in the Core in the emergency department (Authors creation).

The person who remained in the Core also had the overview on information about ambulances arriving with patients under life-threatening patients conditions, and should therefore be ready to enter the trauma room with doctors and nurses when the patient arrives. In the trauma room, the ePMR was present on a wall screen and we observed how the practitioners would use the vital signs and other documented data from the ePMR in further treatment once in the ED. If the patient was not a trauma patient, the information from the ePMR was only visible on the stationary screen or in the case that a nurse or doctor opened the ePMR on a computer elsewhere in the ED. The other researcher would follow a nurse or doctor to observe whether they applied the information from the ePMR and if so, how they utilized it in their clinical practice. Following the ED clinicians provided an opportunity to experience the activities around and within the ePMR's operation and thereby gain an in-depth depiction its utilization.

We were able to identify our physical place as the ED within an urban area, given that we conducted our observations there, and also using Spradley's (1980) social situations as a guide. The actors involved were the previously mentioned healthcare clinicians in the ED, and the activities executed were the clinicians' performed work tasks, e.g. the treatment of patients. After having performed observational studies in both EMS and ED setting, we found it of great interest to look into the third Danish out-of-hours healthcare service, the OOH-GP, as described in Chapter Two. Our focus in the two previous settings was studying the utilization and impact of data availability, which will also be the focus of this third study.

5.1.3 Interviewing Out-Of-Hours General Practitioners and IT-Relevant Individuals

This thesis's methodological framework for generating data was supposed be similar to the foundations we used in our 8th semester and 9th semester: conduct participatory observations and team ethnography (Spradley, 1980; O'Reilly, 2012). We started to plan our ethnographic fieldwork in order for us to enter an urban OOH-GP in the North Denmark Region, in order to observe how data from the MedWin IT system does or does not support the work practice. However, in late February the COVID-19 pandemic reached Denmark and had a great impact on access to the field. To minimize the impact of COVID-19 on Danish society, the government created restrictions regarding access to certain healthcare settings, including hospitals. This put a direct end to our plan of observing an OOH-GP. However, we decided to work with the situation instead of against it, so we came up with another

plan for generating data during this time. Table 3 illustrates the study-relevant activities performed on our 10th semester.

Dates	Activities
11.02.2020	Meeting with Center for Prehospital and Emergency Research.
05.03.2020	Interview with one prominent actor from the Digitalization and IT in the North Denmark Region.
09.03.2020	Interview with one prominent actor from the Danish Health Data Authority.
17.03.2020	Interview with an Out-Of-Hours General Practitioner.
19.03.2020	Interview with an Out-Of-Hours General Practitioner.
23.03.2020	Interview with an Out-Of-Hours General Practitioner.
22.04.2020	Submitting article to Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine.

The date format is in British English.

Table 3: Overview of activities performed on 10th semester spring 2020.

Instead of performing participatory observations, we decided to plan interviews with doctors working in the OOH-GP. We wanted to be as persistent as possible while generating data, so we knew that we had to talk to the OOH-GPs, as they are the direct users of MedWin. Our purpose for performing interviews was to gain insight into the OOH-GP's opinions, attitudes, and experiences regarding data access and data sharing across the three Danish out-of-hours healthcare services (Tanggaard & Brinkmann, 2015). Our collaborative partners from CPER helped us contact and obtain access to various OOH-GPs, yet because of COVID-19, only three were able to participate in interviews.

The semi-structured interviews were held over Skype, and both of us were present along with the OOH-GP being interviewed. We verbally obtained the OOH-GP's consent to audio record the interview at the beginning of our conversation. We planned a strategy in which one of us would act as the facilitator and the other would supplement the interview to elaborate on certain questions if needed. We took turns and the division of labor switched between interviews. This strategy also gave us the opportunity to take notes concurrently. As mentioned, the basis for these three interviews was the use of a semi-structured strategy. Each OOH-GP was asked the same questions for the sake of consistency, which was beneficial when analysing their answers in relation to the problem statement.

We created an interview guide to help us structure the interview, and the questions took form within one of the following three themes: 1) digitalization; 2) current data access; and 3) necessary and/or desired data access. Each theme had between two to five questions, and in all three interviews, new, unforeseen aspects occurred. Furthermore, we reflected on how we could gain insight into and obtain descriptions of their clinical work without being able to physically access the context and setting of the OOH-GP. We decided that each participant should describe, in detail, the process and timeline from the beginning to the end of a patient consultation. This was not only to paint a picture of the consultation process, but also to clarify how MedWin and access to other patient data does or does not support the interviewees' clinical work in the OOH-GP.

Furthermore, we wanted to unfold perspectives regarding the possibilities and limitations of sharing and accessing data across the Danish healthcare sector. To obtain these perspectives, we e-mailed two prominent actors within relevant sectors, one working in the digitalization and IT industry in the North Denmark Region, and the other from the Danish Health Data Authority. These actors agreed to contribute to our thesis by participating in semi-structured interviews. In the following section we will present how the semi-structured interviews were formulated and carried out.

These semi-structured interviews were based on an interview guide containing the same questions and involving the following themes: 1) understanding healthcare data; 2) data in relation to OOH-GP; 3) an overview of patient data for healthcare clinicians; 4) digitalization in healthcare; and 5) political aspects. Both professionals received the questions prior to their interviews, which gave them an opportunity to reflect on the issues beforehand. The semi-structured interviews were held in the respective institutions of these two experts – at the offices of the Danish Health Data Authority in Copenhagen (See Picture 4) and at the IT headquarters in the North Denmark Region (See Picture 5).

Picture 5: Picture taken by us. Showing the entrance sign at the Danish Health Data Authority in Copenhagen.

Picture 4: Picture taken by us. Showing the entrance sign at IT-headquarter in the North Denmark Region.

Prior to audio recording the interviews, we obtained written consent from the two interviewees. From this point on, we will call the digitalization and IT professional *Michael*, and the Danish Health Data Authority employee *James*. It is crucial to note that these pseudonyms are used in order to protect the identities of any and all participants included in this thesis.

All of the interviews performed with the OOH-GPs and the prominent experts in digitalization/IT and from the Danish Health Data Authority were transcribed by the authors into text (Tangaard and Brinkmann, 2015), and analysed as described in section 6.2.1 [Grounded Theory Approach].

6.0 Analytical Framework

In this study, we will frame our empirical data using Glaser and Strauss' (1967) Grounded Theory method, as it supports our inductive approach. We also apply Clarke and Friese's (2007) situational analysis to code and systematically analyse the data generated from all included field sites. By coding the data various categories emerged, and we created a conceptualization called UTOPIA that constitutes our analytical framework. Subsequently, we present Star and Griesemer's (1989) idea of boundary objects with the purpose of presenting our preliminary interpretation of Danish EMRs.

6.1 Grounded Theory Approach

Glaser and Strauss (1967) presented the grounded theory as a way of challenging 'grand theory.' They found that 'grand theory' was prevalent among researchers, but that there was little cohesion to the research which was being performed. Grounded theory was developed with the base of having a research methodology for generating theory specifically suited to the performed research (ibid.). Glaser and Strauss argued that anyone studying social phenomena such as industrial, educational, or political issues and using data, particularly qualitative, can employ the grounded theory approach (ibid.).

Glaser and Strauss (1967) advocate that theoretical sampling is an indispensable process in relation to data collection, as the researcher collects, codes, and analyses data, and then subsequently determines where and what to generate data-wise (ibid.). We applied this thinking as we performed our ethnographic observations in the EMS and ED. Prior to our entrance in the field, we brought awareness to local concepts, actors, and processes in the respective field sites. For example, in the EMS there were both ambulance professionals and a prehospital anaesthesiologist, which provided a foothold for us as we gathered data. Glaser and Strauss (1967) furthermore present how researchers should determine which groups are being involved for comparison. The actors involved in this thesis were chosen based on being a part of the three Danish out-of-hours healthcare services, which provided current maximization or minimization of similarities and differences amongst EMS clinicians, ED clinicians, and OOH-GPs. Though the actors involved were found to have differences, they are still quite comparable groups due to their activities within the field of after-hours emergency medicine, which helped support the categories found in the data gathered amongst all groups. As we

have included data generated in previous semesters (spring and fall semesters of 2019), we have performed a secondary analysis on our large data sets from these semesters. To this data mass, along with the data we generated in our 10th semester, we have applied a concept containing density of properties and categories.

To analyse this large mass of data, Glaser and Strauss first presented two general approaches of how to code and analyse the data, 1) coding all data and 2) inspecting data and revisiting/redesigning a theory under development. However, they immediately criticize these approaches as they are not congruent with 'grounded-theory-thinking' (ibid.). Subsequently, Glaser and Strauss suggested a third approach:

> "We wish to suggest a third approach for the analysis of qualitative data – one that, through an analytic procedure of constant comparison, combines the explicit coding procedure of the first approach and the style of theory development of the second. The purpose of the constant comparative method of joint coding and analysis is to generate theory more systematically than allowed by the second approach, by using explicit coding and analytic procedures. While more systematic than the second approach, this method does not adhere completely to the first, which hinders the development of theory because it is designed for provisional testing, not for discovering, hypotheses." (Glaser and Strauss, 1967, p.102).

For coding and analysing our large data set, we applied Clarke and Frieses' method (2007) as they base their thought process on Glaser and Strauss. Clarke and Friese's situational analysis is founded on being able to systematically analyse qualitative data – when the data were generated by actions of actors in local situations (ibid.). Situational analysis has provided a strong, ongoing comparative analysis of our data from the EMS, ED, and OOH-GP, and furthermore enabled us to revisit our data with explicit and systematical codes as new data categories emerged (ibid.).

By performing mapping such as that of Clarke and Friese, we were able to comprehend all of the data we generated. The mapping assisted us in understanding the awareness of user perspectives. Furthermore, it was easier to revisit our data, as the mapping created an overview. A visualisation of our messy map is shown in Figure 13.

Figure 13: Messy map of generated empirical data from the three Danish out-of-hours healthcare services and from the interviews performed with Michael and James.

Mapping made it possible for us to compare the data generated across the different sources and contexts we investigated. Our data was situated around our problem statement and illuminated Glaser and Strauss' way of thinking about analytic procedures, explicit coding, and theory development (Clarke and Friese, 2007; Glaser and Strauss, 1967). Though it had not been important to us to generate a new theory as grounded theory suggests, we ultimately chose this approach because it provides comprehensive modes of categorizing our codes – descriptions and explanations found in the generated data.

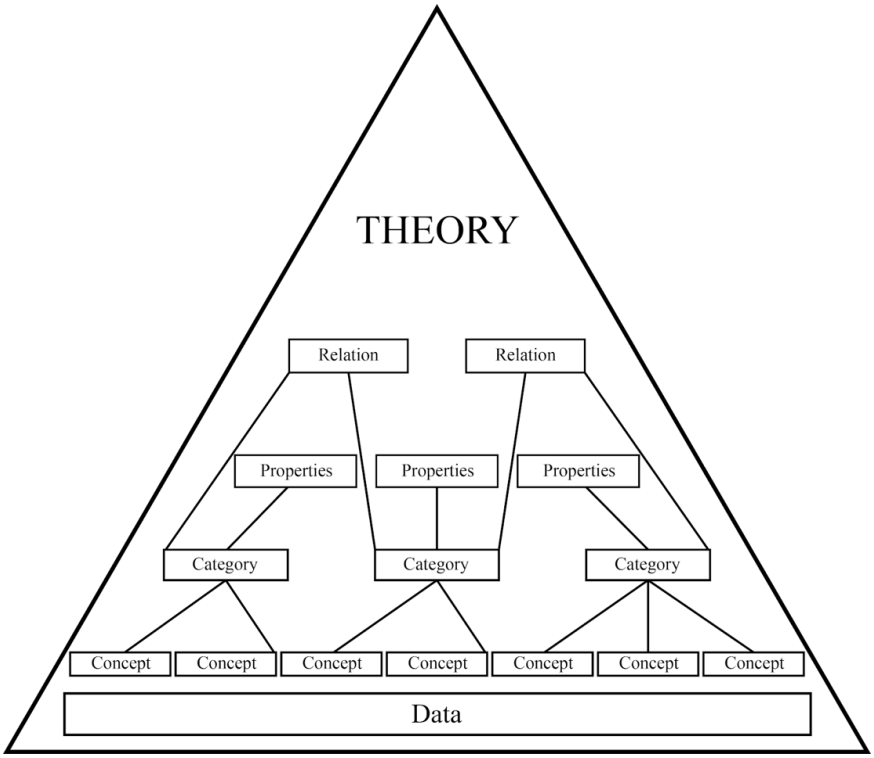


Figure 14: Storyline of how a theory/conceptualization emerge according to Grounded Theory (Authors creation).

Figure 14 illustrates the storyline for employing grounded theory in relation to development of theory. All generated empirical data is the foundation for development of theory, as we, by applying situational analysis from Clarke and Friese (2007) generated codes, which we compared, hence compared data with data, and multiple concepts emerged (Clarke and Friese, 2007; Bryant and Charmaz, 2007). Revisiting our data as a part of the iterative process, we compared the emerged concepts with one another, subsequently organized these, and categories arose.

Grounded theory provided an inductive analytic approach in relation to our large mass of data and as result, various categories emerged: 1) United; 2) Towards; 3) Organizational; 4) Process-driven; 5) Interrelated; and 6) Architecture. In relation to this, we feel prompted and eager to present the overall thematic framework within our data, as we want to apply the categories that emerged as tools for analysis. Utilizing grounded theory, we have had the opportunity to create a conceptualization suited for the specific research we carried out (Glaser and Strauss, 1967). We want explicitly clarify that the categories that emerged and are presented above *could* constitute a suggestion of UTOPIA theory, yet this is not the purpose of this thesis - the purpose is to answer the problem statement: *How do healthcare clinicians working in the three out-of-hours healthcare services experience current patient data availability as well as describe potential sharing of patient data across healthcare settings?*

The term utopia is well-known because of its definition from Thomas More's 1516 philosophy, however, this study will employ a translation of More's description by Clarence H. Miller (Miller, 2001). More created an island called 'Utopia,' and in his text he goes through topics such as: religion, relatives and family, their magistrates, social relationships, and more (ibid.). More's definition relies on the island of Utopia (ibid.). He describes and compares social, ethical, economical, and cultural aspects of the island to aspects from other countries – especially England (ibid.). Utopia is described as the ideal society which is pleasant and full of wealth for its citizens. An important aspect to notice is how More determines that the concept of an ideal society, or a utopia, could never exist in the real world (ibid.).

Furthermore, we are aware of the "UTOPIA project," which had the purpose of involving graphic workers' interests and concerns in the process of developing technology for their work practices (Kensing and Greenbaum, 2013). The project applied participatory design methods and techniques to include the workers, which resulted in new aspects that required user perspectives in its development (ibid.).

Our conceptualization of UTOPIA can be said to take inspiration from More's foundation; however, we see our utopia as something which could potentially exist in the healthcare world. As previously presented, our conceptualization of UTOPIA stands for '*United Towards Organizational Process-driven Interrelated Architecture'*. We present our concept as an approach to understanding organizational processes. Additionally, UTOPIA relies on an iterative thinking process, which makes it possible to perform provisional testing of our identified categories, just as in Glaser and Strauss' grounded theory (Glaser and Strauss, 1967).

6.2 UTOPIA

In this section, we present how we have used the categories identified within the empirical data as vocabulary and strategy to organize our interpretation of our data. From our empirical data, we identified that the actors involved described, and that their actions reflected, certain goals and values that were considered essential and which were somewhat expressed to be their overall target when performing their work. Our data furthermore indicated that the actors involved more often would share the same or similar targets. Therefore, we named this category "United." Another pattern that emerged from the large mass of data was that the actors involved described, and we observed, that their performed activities moved them towards the targets. We named this category "Towards," as it consists of all movements, decisions, and actions carried out by these actors in order to achieve their targets. We have stated that the empirical data is based on descriptions and actions from a group of actors – the participants in our thesis – and we will name this group of actors involved "Organizational." The actors involved hold interest, knowledge, and competencies that relate to their respective targets. While coding our empirical data, we identified a category in which the participating actors reflected on procedures that could potentially sharpen organizational processes and efficiently achieve their respective targets. We named this category "Process-driven." Furthermore, we found reflections amongst the participants that revolved around shaping and optimizing organizational processes. These reflections were interrelated, or considered necessary to become interrelated, in order to achieve a desired target, so we identified this category as "Interrelated." Finally, our problem statement revolves around the actors' descriptions of potentially sharing patient data across healthcare settings, which was revealed by our empirical data descriptions and examples of an IT architecture for such purposes. This, together with the elements described above within the U, T, O, P, and I categories, constituted the last category, which we named "Architecture."

The initials from the categories identified spell out the word UTOPIA, which is the conceptualization we have utilized within our analysis of empirical data. Furthermore, we have the opportunity to provisionally test our problem statement as we continue to revisit the empirical data. Additionally, through our focus on the three Danish out-of-hours healthcare services, we will later be able to identify whether they have a united target, what that target is and how it can be accomplished, what processes in existing work practices take part in reaching this target, and whether there is a need for other elements to be involved in the activities towards this potential common target within the field of emergency medicine. The figure below contains a description what of each letter in UTOPIA stands for to provide a manageable overview of UTOPIA:

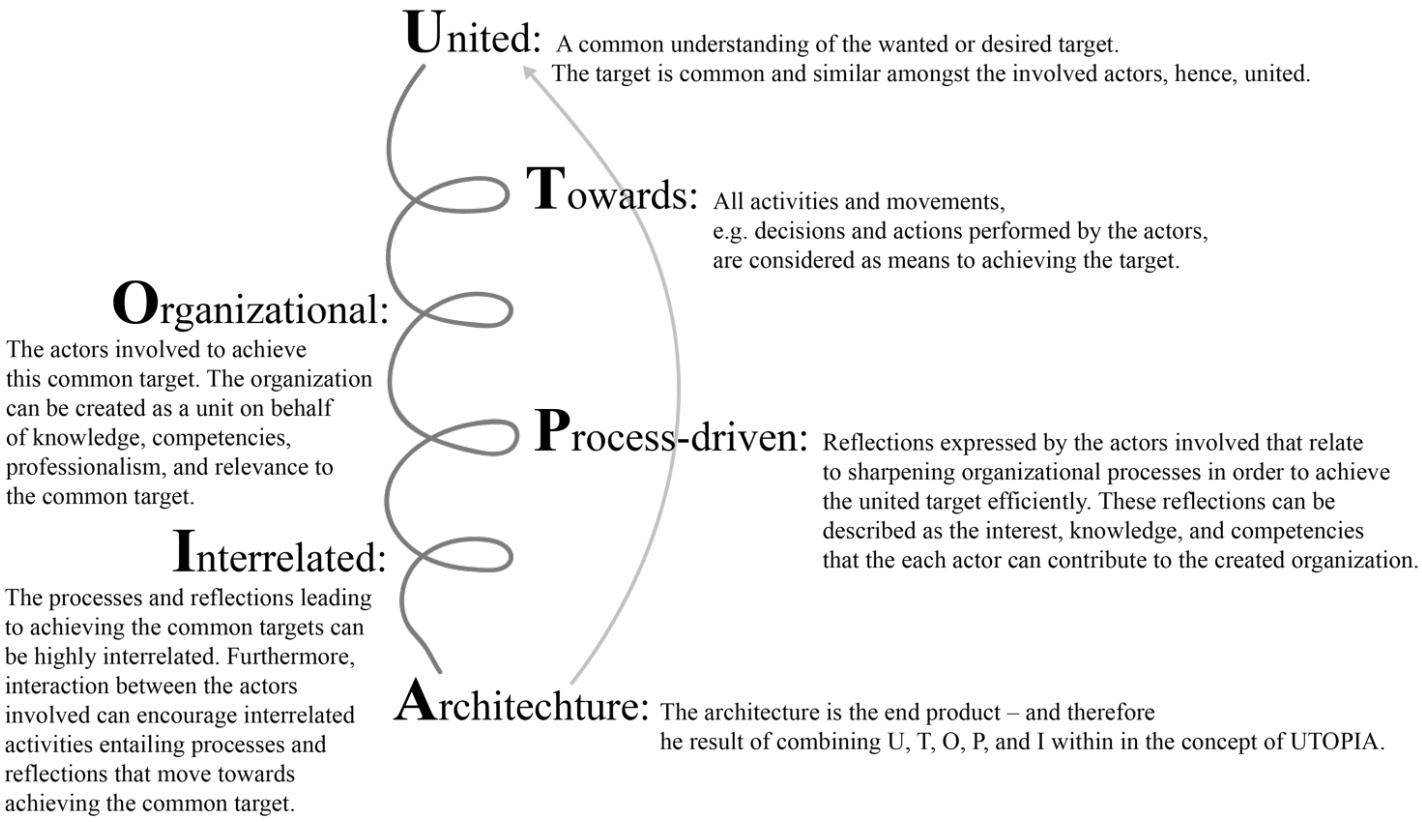


Figure 15: Visualization and description of each letter in UTOPIA. The definition of each letter is based on the generated empirical data (Authors creation).

6.3 Boundary Objects

The concept of boundary objects was first introduced by Star and Griesemer (1989) to conceive artifacts that facilitate translation, communication, and cooperation across social worlds simply by being (Star and Griesemer, 1989). Boundary Objects are described as artifacts or objects that originate in different social worlds, yet establish a shared context where the involvement of fundamentally different meanings becomes coherent. Star and Griesemer (1989) define Boundary Objects as:

> "[...] objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use and become strongly structured in individual side use. These objects may be abstract or concrete. They have different meanings in social worlds, but their structure is common enough to more than one world to make them recognizable as a means of translation" (Star and Griesemer, 1989 p.393).

In this thesis, our preliminary interpretation is that EMRs are boundary objects within the three out-of-hours healthcare services. We will apply the concept of boundary objects within the discussion in chapter 8.0. Since boundary objects have a stabilizing effect on collaborative activities, we find it relevant to disclose and discuss the meaning of EMRs across healthcare settings (Star and Griesemer, 1989). However, boundary objects only have stabilizing effects towards collaborative activities if they are considered useful and appropriate, which is an important aspect when investigating the EMR as a helpful work tool across settings. Furthermore, managing boundary objects is essential in developing and maintaining coherence within the different yet intersecting social worlds (ibid.). In a study performed by Bossen et al. (2013), it was suggested that maintaining and upholding the quality of boundary objects could be articulated as 'trimming.' Moreover, it was stressed that maintaining and trimming the contents of the EMRs could be a way of improving the stabilizing effect of collaborative activities, and therefore maintain commonality and coherence within the various intersecting social worlds. We will apply the mindset of boundary object 'trimming' in a discussion related to the shaping of a utopian architecture for sharing patient data between healthcare clinicians in the three Danish out-of-hours healthcare services.

7.0 Analysis

This analysis is based on the empirical data we generated in our 8th, 9th, and 10th semesters, and is presented the following UTOPIA analytical framework. For each category in the UTOPIA framework, we discuss our empirical findings referring to the different settings/actors we observed/interviewed: 1) EMS; 2) ED; 3) OOH-GP; and 4) IT-relevant personnel – i.e. Michael and James. We begin by analysing the categories in that order, starting with United.

7.1 United – The Common Target

To comprehend the conceptualization of utopia within this thesis, we first have to identify whether and where common targets occur amongst the actors. In UTOPIA, *United* relies on the actor's individual statements and expressions. To apply UTOPIA further as a concept, we will analyse each of the involved actors' targets. The actors involved are the ambulance professionals, the ED clinicians, the OOH-GPs, Michael from the digitalization and IT sector in the North Denmark Region, and James from the Danish Health Data Authority.

7.1.1 Ambulance Professionals Saves Lives

While performing our ambulance ride-along, we asked ongoing questions about the ambulance professionals' utilization and experience of the ePMR on the tablet computer. A pattern that repeated itself was how the context played a great role in their usage of the ePMR. For example, if the patient was seriously injured, ill, or in a life-threatening situation, the ePMR was put aside. A field note from our observations described:

> "We arrive at the site of the accident and none of the ambulance professionals take the ePMR with them – patient treatment is the focus now. I notice that the leader managing the accident has an ePMR and has the overview of the situation, and is directing the different ambulance professionals towards the assigned casualties. When the patient is brought inside the ambulance, the ePMR is started up. They ensure that the social security number matches that the patient but start collecting the patient's medical history without the ePMR, focusing only on the patient. After the situation is under control, the ambulance professional starts documenting the events and information on the ePMR, but the patient

> is quite anxious, so the ambulance professional has to shift their full focus towards the patient again. When the patient is calmer, the ambulance professionals register data and document information. The ambulance professional needs to take additional vital signs, as the patient suddenly feels pressure on their chest and also begins to hyperventilate. He doesn't have time to use the ePMR and it remains in its container." [Fieldnote, Observation, Day shift].

Furthermore, in every ambulance ride-along, we observed that the patient was the primary focus and that documentation of patient treatment in the ePMR was second priority. However, an ambulance professional stated that it can be hard to keep focus on the patient and provide care when they have to simultaneously document information in the ePMR while the patient is in the ambulance. During our period of observations, multiple ambulance professionals expressed this opinion, which was recognized as a manifestation of great attentiveness towards their primary work tasks, which involve saving lives, providing care, and improving the patient's health conditions. Even though the ambulance professionals provided suitable care for the patient while in the ambulance, they would still have to rush to the hospital when dealing with life-threatening or trauma situations, as they did not have the adequate equipment in the ambulance to handle such cases. In a case like this, the ambulance professionals had to communicate with ED clinicians, and the ePMR was not sufficient for this. It could not provide the fast and necessary communication of patient information to the ED clinicians waiting for the patient's arrival. Instead, the ambulance professionals would directly call the ED by telephone while still treating the patient. The ambulance professionals would relay the patient's status so that the ED clinicians could prepare themselves. Here is field note which stresses and points towards the ambulance professionals targeted work practices:

> "We talk about the value of being able to call the ED when a trauma patient is coming in – you then know and are assured that they gather the right team within the hospital. This would not work using digital means since there is a risk that the ED nurses will not notice the ePMR-screen and therefore will not see the trauma patient we are treating. Also, it is a lot faster to describe the situation to the coordinating nurse over the phone as opposed to documenting everything in the ePMR." In addition, the ambulance professionals emphasized that "You have to treat the patient and save the patient! That is your number one priority." [Fieldnote, Ambulance professional, Day shift].

In our observations it was evident that the target in the ambulance professionals' work practice was, unquestionably, to enhance the progress of patient care. This aligns with the practice of working within emergency medicine and out-of-hours healthcare services, as they have to perform work related to saving lives, provide care, improve health conditions, and create safety for patient.

7.1.2 Emergency Care for Patients in the Emergency Department

Through the observations we made in the ED, we found that ED clinicians' work is different from that of ambulance professionals. An ED clinician described the practice:

> "We provide emergency care for patients. Some patients have a higher need for instant care when arriving in the ED, and some can wait to receive treatment. Yet, we have to address and assess every patient within four hours of their arrival. Patients are triaged to identify their health status, so that the most injured and ill patients can receive care first. However, if an EMS vehicle or helicopter brings in a patient with a life-threatening situation, we have an emergency. The trauma team will be standing by to take over patient treatment for the EMS clinicians. Our role, when working in the ED, is to keep the patient flow moving in order to treat and refer the patient to the next appropriate in-hospital treatment." [Fieldnote, ED clinician, Day shift].

We saw that there were many important objects that had to be in place for the ED clinicians to perform their work tasks, such as empty beds in the ED, access to relevant patient information, well-functioning communication amongst the ED clinicians, other colleagues within hospital and EMS clinicians, and overall coordination. Regarding the access of patient information, a coordinating nurse and emergency doctor articulated the following:

> "It would have been nice to have more information on this patient (emergency doctor points to the ePMR-screen) before he arrived. Many times, we lack information concerning patients arriving with EMS. It would have been of great benefit to us to have access to this information, as we could have better prepared ourselves and considered the flow here in the ED." [Fieldnote, ED clinicians, Night shift].

An emergency doctor clarified how more available information from ePMR would have benefited the patient, as the ED clinicians would have had the possibility to learn more about his present status, and thus immediately go ahead with treatment instead of starting by assessing the patient's condition. Regarding available information, we have previously demonstrated how EMRs in EDs consist of both the ePMR and an in-hospital EMR. Still, we observed sparse usage of the ePMR by ED clinicians. Most of the patient information was accessed from the in-hospital EMR, yet we only observed this a few times. In almost every situation, the floor nurse would go directly to the patient and gather information rather than read it beforehand. In this sense, the floor nurse prioritized the subjective information provided by the patient. It was evident that the patient was the focus in the ED. All coordination, treatment, planning, and so on, happened with a patient-centered focus. We saw how the ED clinicians worked in coordination with many diverse actors to provide the best patient care and to keep the flow of patients moving. This observation was backed up by a statement from a coordinating nurse:

> "I really care for the overall flow in the ED. I absolutely love it. I like the interdisciplinary work with the ambulance professionals, doctors, nurses, secretaries, hospital porters, etc. We work together with the same objective and purpose: the patient." [Fieldnote, ED clinician, Evening shift].

In the above we stated that the ED clinicians' goal was to *provide quality care for the patients*, which was often done by collaborating with other healthcare professions and specialists. Furthermore, we have found how a well-managed workflow in an ED can lead to effective prioritization of patients according to injury and/or illness. Still, we identified a need for greater patient information data availability, as the poor facilitation of available data had negative consequences for decision making in relation to patient treatment. The above analysis of our observations indicates that the ED clinicians centered on providing emergency care and treatment for patients.

7.1.3 Out-Of-Hours General Practitioner Helping Patients

Referring to our three interviews with OOH-GPs, we will examine what they consider to be their targets and goals. In all three interviews we asked the following question: "What is most important to you, when working as an OOH-GP?" To this, one answered:

> "Oh. The most important is to be able to help the patients with the problems they have – as fast and efficiently as possible, as it is often is busy in the OOH-GP. But when you ask about the most important thing, then it is to help the patients with their problems." [Interview, OOH-GP].

The remaining OOH-GPs expressed the same sentiments, and one pointed out how the patient was also considered to be the most important source of information, regardless of any telephone consultations, physical consultations, or home-based consultation performed by the OOH-GP. He stated that the patient's subjective depiction of their illness or injury was the most reliable and would help to determine further treatment or the necessary referral. Another OOH-GP backed this up, as he described how the OOH-GPs' understanding of the situation would increase through contact with a direct source of information regarding the illness or injury, which could either be the patient or a relative of the patient. When performing in-hospital physical consultations, they described how they would measure clinical vital signs, perform different examinations, and so on. One OOH-GP stated how they would sometimes access the in-hospital EMR to look up information or document findings in MedWin. However, this action was limited as it was rather time-consuming:

> "You should think of…for every minute we are sitting and looking at the computer screen, no matter if it is to read or document information, it is minutes taken away from the patient. This means that every moment we are not listening to, not examining, and not advising the patient, every time we do something that increases the time, we have to sit in front of the computer screen, it is time taken away from the patient." [Interview, OOH-GP]

The above statements taken from interviews with the OOH-GPs present how their work all revolves around the same aspect: focusing on the patient during their consultation at the OOH-GP. We do not see any further reason for adding data from our interviews with these OOH-GPs, as their target goal

was hardly misinterpreted. Their target was to *care for and help the patient with their particular problem, illness, or injury*.

Until now, we have found and presented how the three Danish out-of-hours healthcare services all have a common goal, which is to *provide care, save lives, help the patient, and improve the patient's health condition*.

7.1.4 IT Systems and Health Data

We conducted two interviews regarding IT systems and healthcare data: one with Michael, an expert from the Digitalization and IT office in the North Denmark Region, and one with James, a data analyst from the Danish Health Data Authority. In these interviews we found that their work is very different from that of the people working in the three Danish out-of-hours healthcare services, meaning that it is important to understand their targets and goals as well.

In both interviews, Michael and James talked about IT systems in healthcare settings and the extent of their possibilities. Each presented examples of ongoing pilot projects with the purpose of improving certain IT elements, such as better arranged patient information for healthcare clinicians, easier accessibility, as well as security for patients' health data.

Furthermore, in both interviews the men stated multiple times that data nowadays is redundant and, in some cases, incalculable. Michael expressed how much data exists, how the field of data had grown immensely over the past years, and that health data is utilized for many different reasons, including demographic calculations, patients' personal data in clinics, and sensor-based data collected from self-monitoring. Moreover, Michael expressed how digital assistants have had a great impact in recent times, as they have been able to support healthcare clinicians on patient care progress, and he added:

> "They (doctors) are great – if it just makes sense for the patient and makes sense for the doctor, then they are ready, no problem at all. No matter how complex it is, they will learn it. As long as it makes sense. And, I think that it is a good principle, believe it or not, that the patient is always the most important figure in their (OOH-GP) world. Not themselves.

> They care a great amount for the patients and their wellbeing. It is a good call they have there." [Interview, Michael].

Both Michael and James stressed how data was important for clinicians working in healthcare, and how data could be a constraint if not presented correctly to its user(s). However, both recognized that the more data are being applied, interpreted, and aggregated, the more knowledge it would be able to provide. In both interviews we discussed what the citizens' role was in relation to data, and each described how data was used for patient treatment in healthcare settings, and that citizens should have control over "their data." Through these interviews we found, and Michael and James described, that facilitating IT systems applicable to healthcare professionals was central. Furthermore, Michael and James's work did not revolve directly around the physical patient, but rather around a representation of the patient through necessary data processes for estimating and foreseeing the health of the Danish population. Additionally, they involved user needs in their development of IT systems for clinicians working in healthcare settings.

Above, we have determined that Michael and James share the same perspectives in relation to *creating and developing feasible circumstances for healthcare clinicians through an IT system*, which we have identified as their common goal.

At this point in our analysis, we have seen that the common target amongst the actors in the three Danish out-of-hours healthcare services was to *enhance patient care progress,* and how Michael and James shared the goal of *creating suitable circumstances for healthcare clinicians through IT*. Combining the two targets identified above, we can state that the common target for all five groups of actors involved in this master's thesis is *to shape a system that provides access to useful patient data, hence enhancing patient care progress*. The common goals represent the *united* part of our concept of UTOPIA, as it both directly and indirectly encompasses the same theme: patient care progress. In the following section we will analyse how the actors perform activities and movements in line with this common target.

7.2 Towards – Activities and Movements

Within our conceptualization of utopia, *towards* is really its primary basis. *Towards* represents all the activities and movements that were performed in order to attempt to reach the common goals. To identify what lies within the concept of towards, we need to look at our actors' movements and actions, as they indicate the means of the targets. Furthermore, this allows us to revisit our generated data which supports the purpose of provisionally testing our problem statement. First, we will examine how we have observed the EMS and ED clinicians' movements and activities regarding this target. We will follow this with an analysis of how the OOH-GPs, in conjunction with Michael and James, described their movements and activities in relation to their respective targets.

7.2.1 Ambulance Professionals and Prioritization of Patients

During the 64 hours of observation and ride-along in ambulances, patterns concerning the ambulance professionals' work practice in EMS became evident. The EMCC would send assignments to the ambulance professionals' radio, after which the ambulance professionals would head to the ambulance, located at the station. Furthermore, the ambulance professionals shared with us how they used the message provided by the EMCC to prepared themselves for whatever situation awaited them at the scene of the injury. In the message they could see the patient's name, address, gender, level of emergency, and a description of the injury or illness. The ambulance professionals expressed multiple times how being able to prepare was beneficial when working in emergency medicine, as they had to act fast for the wellbeing of the patient. Using the content provided in the EMCC message was evidently a movement that the ambulance professionals performed in order to prepare for arrival at the injury scene as well as for patient treatment.

When the ambulance arrived on-scene, the ambulance professionals would stop the ambulance, and both would address the patient. We observed that in almost every case, the ambulance professionals would carry the ePMR tablet computer with them. However, depending on the context, there were some situations in which the ambulance professionals would rush to the patient and not take any assistive tools. An example of one such situation is described in the following field note:

> "We arrived at a motorcycle crash site. Several ambulances were on scene, together with the police and a prehospital doctor who arrived in a rapid response vehicle. The ambulance professionals rushed out of the ambulance without any assistive tools (and also without the ePMR). I followed them closely. The prehospital doctor had used his ePMR to assign the individuals at the scene to different ambulances. The ambulance I rode along with was in charge of transporting the person who had crashed the motorcycle. They (the ambulance professionals) told me that the prehospital doctor had identified all of the patients by social security number, so it was not necessary to bring the ePMR with them – however, it was urgent to address the patient quickly to identify the needed treatment." [Fieldnote, Observation, Day shift].

This field note represents a depiction of how the ambulance professionals performed movements and activities which were directed towards the best patient treatment. It also details the use of assistive tools, e.g. the ePMR. Moreover, the field note indicates a movement towards saving the patient's life, thus towards enhancing the patient care process.

After the ambulance professionals had addressed the patient on-scene, in most cases they would bring the patient into the stretcher compartment of the ambulance. Here they would initiate patient treatment. In some situations, the ambulance professionals would perform documentation of patient data concurrently while treating the patient, and in other situations, they would not have time to document anything, as the patient was in need of severe treatment. This could be identified as a movement towards their number one priority: treating and saving patients' lives.

As ambulances arrived at the ED, the ambulance professionals would take the patient, on the stretcher, into the ED. Here they would verbally hand over the patient to a coordinating nurse in the ED, which was supported by using the ePMR as an assistive tool, described in the following field note:

> "We saw that the ambulance professionals would often place the tablet computer with the ePMR on the counter, in the Core of the ED. While conducting a verbal handover to the coordinating ED nurse, we observed that the ambulance professionals would click through the content of the tablet computer while simultaneously adding information as

they moved forward. It seemed as if the ePMR functioned as a checklist." [Fieldnote, Observation, Evening shift].

Through our observations in ambulance ride-along we found that the ePMR supported collaborative activities with the ED, for example, during a patient handover. The ambulance professionals found the ePMR useful for sharing patient information with the coordinating nurse, which would potentially benefit the overall patient care progress.

After the patient handover, the ambulance professionals would return to the ambulance. One of the ambulance professionals would clean up, count supplies, and collect missing ones, and the other would focus on completing the documentation of patient data. We observed how the ambulance professionals filled out the rest of the modules. An ambulance professional described how the distance of the ambulance drive and the amount of necessary patient treatment influenced the extent of the documentation that they could complete before reaching the ED. Moreover, we observed that working in an urban area impacted the amount of documentation completed before arrival, due to short distances between the scene of the injury to the ED.

7.2.2 Prepared for Changes in the Emergency Department

Through our observations in the ED, we both identified and were told that the ePMR supported patient handovers, as it facilitated the exchange of information to both prepare medical teams like in-hospital specialists, and to manage the ED's patient flow. The ED clinicians expressed that the notes and vital signs found in the ePMR were valuable in order to prepare themselves as well as to evaluate patient progress. One ED clinician said:

"We don't always get to meet the ambulance professionals and then we miss out on the verbal handover. Therefore, it is important that we can access patient information in the ePMR in order to evaluate the patient's conditions and development here in the ED, as well as confirm and match information, such as the development of vital signs, and whether there is any discrepancy in what the patient tells us and what they told the ambulance professionals." [Fieldnote, ED clinician, Day shift].

Furthermore, we observed that medical secretaries in the ED would print out referrals from GPs and OOH-GPs, which had been received electronically, and place them on a shelf in the Core. The ED clinicians would utilize these referral notes before addressing the patient, which they said was to prepare the patient's treatment and care. A pattern that repeated itself was that the coordinating nurse and doctor would be located in the Core, which was beneficial when preparing for patients arriving under life-threatening circumstances. From this location, they could access further patient-related information on the stationary screen with the ePMR. The coordinating nurses and doctors described that they would attempt to create a patient overview by utilizing supplementary electronic whiteboards, which held information regarding patients already in the ED as well as information in the ePMR, to prepare for patients arriving by ambulance. We observed that when waiting for an extremely injured or ill patient, the coordinating nurse and doctor would, while talking with the ambulance professional by phone, access information in the ePMR. This way, for example, they could see the most recent blood-pressure statistics that were taken in the ambulance, in order to interpret the patient's condition. The ED clinicians described how the information available in the ePMR supported the creation of patient overviews, as well as the preparation regarding which specialists to involve upon patients' arrival. Our observations concerning how the ED clinicians prepared for patient arrival via ambulance points towards movements enhancing the patient care progress by using information available in the ePMR. An important aspect of the ePMR as an assistive tool was that the general overviews were identified as well-functioning. Yet, in most situations, the ED clinicians could not access further patient information, as further information was only documented in the ePMR when the ambulance professionals had finished the entire ePMR. While observing the ED, the clinicians described that notes in the ePMR were considered valuable in assessing the patient, as the notes contained subjective descriptions gathered by the ambulance professionals, including information on the patient's mental state. Still, this was almost never completed before the ambulance's arrival at the ED due to the short urban distances, creating difficulties for ED clinicians trying to prepare for patient arrival.

Besides the ePMR, supplementary electronic whiteboards were present in the ED's Core. On these whiteboards, the coordinating nurse and doctor would keep an overview of the patient's vital signs and status. It was possible to move patients around on the digital screens, which was done by the coordinating nurse and doctor when they met on a shift. By doing so, they would get an overview of patient flow in relation to planning and delegating patients and related treatment. In most cases, they

would keep two rooms free for patients with severe injuries or illnesses, and they would also have an available trauma room. However, on some days this was not possible due to the number of patients in the ED. When the ED was crowded, we saw that the coordinating nurse would look at the whiteboards more often than when there were few patients in the ED. The coordinating nurse and doctor would utilize the patient information from these whiteboards to stay informed, and a coordinating doctor commented the following:

> "It (patient information) is valuable. Everything needs to be documented in the healthcare sector. But it is also important in terms of evaluating the patient's conditions and development while here as well as confirming and matching information, for example, the development of vital signs, with whatever the patient is telling us. A lot can happen in 15 minutes and it is important that you can follow the patient's development and condition in every possible way." [Fieldnote, ED clinician, Night shift].

It was rather obvious how the work practices progressed around and were affected by the number of patients in the ED and the type of treatment needed for each individual patient. Managing patient flow in the ED was identified and observed to be challenging because of unpredictable patient flow, yet the information on the whiteboards and the ePMR seemed to help better manage this flow. We additionally observed how clinicians working in the ED provided care and treatment for a broad range of injured and ill patients. The ED clinicians were adaptable regarding switching tasks as well as thrived at resuscitation.

7.2.3 Performing After-Hours Primary Care

In the interviews with OOH-GPs, they described the consultation structure within the OOH-GP system, which entails the following:

> "When working as an OOH-GP, we have three overall consultation structures. First, you can sit and attend to telephone consultations. You answer incoming calls from patients or their relatives who call a GP after hours. Second, you can be located in a consultation room that patients enter after being assessed through a telephone consultation. Typically,

> the consultation room will be in specially-equipped rooms at hospitals. Third, there is the out-of-hospital OOH-GP, where you drive to visit the patients." [Interview, OOH-GP].

The OOH-GPs said that they have all worked within the three consultation structures and were all familiar with MedWin, the EMR system being used in the OOH-GP. In these interviews, we found that the utilization of MedWin depended on which of type of consultation structure the OOH-GP was performing as well as on the patient's condition. They all described that patient treatment was the most important step and that documentation would take place afterwards. However, during the interviews, they acknowledged that documentation was necessary. One of the OOH-GPs said that documentation was mostly to ensure keeping a line of retreatment open, as well as being a precaution. Patient information in MedWin was considered limited but useful in providing an interpretation of the patient's condition and gaining an overview of the patient, such as any earlier contacts or communication with the OOH-GP. An OOH-GP described the case of managing telephone consultations:

> "When managing a telephone consultation, you meet and log on to the IT system with your ID and code. Afterwards, you are ready to answer the first call. The calls are presented on a list, and you just start from the top. Most of the time there are multiple doctors in the room, but sometimes you sit alone. There is also an attendant who is responsible for maintaining an overview of a different district in the Region. In the case that one district is very busy, and another is not, the attendant coordinates sending backup help to the busy district. When providing a telephone consultation, you can see the name and sex of the patient, as well as how many times the patient has been in contact with the OOH-GP. During the telephone consultation, you can either end the call by providing treatment advice to the patient while on the phone, directing the patient to the hospital, or sending an OOH-GP out to the patient's residence." [Interview, OOH-GP].

In relation to performing in-hospital physical consultations, an OOH-GP expressed that he had the opportunity to access external healthcare platforms containing patient information, such as their common medicine card, through the stationary computer located in the consultation room. The OOH-GP added that a paraclinical examination of the patient provided helpful information regarding the patient's condition and the following information was taken during the consultation: measuring vital

signs, using tools such as an ultrasound when necessary, taking a blood sample, and much more. Nevertheless, all of the OOH-GPs stated that the most important and worthwhile information they have access to was the description of the injury or illness provided by the patient, particularly in the case of in-person hospital and home consultations. In relation to this, one OOH-GP presented the concept of "the four Fs" which were employed to understand and help the patient:

> "We are used to something called the four Fs: Feelings (følelser), Expectations (forventninger), Imaginations (forestillinger), and Function (funktion). Feelings represent whether you have anything that is concerning you. Imaginations is what you imagine the injury or illness to be. For example, it can be important for a patient with a history of back problems that they are imagining their herniated disk out of place or something like that. Then you speak with the patient about their imaginations to address the problem, which is important. Then there are expectations. If the patient arrives with the expectation of getting an x-ray of their back and you as doctor don't see the need for it, it is important to address why it is not necessary. Finally, there is function. What is it that the patient can't do now that he or she used to do? That counts for a lot and is important for the treatment of patients." [Interview, OOH-GP].

The content from the interviews, together with the statements of the OOH-GPs presented above, indicated how information was applied in the movement of providing appropriate further referrals. Furthermore, it showed how the various ways of gathering patient information became an integral part of activities, which ultimately helped to understand the patient.

Throughout the interviews, the OOH-GPs described that when performing home-based consultations, they drove from consultation to consultation in a specially-equipped taxi just for them. One OOH-GP commented that the taxi driver would connect a laptop to a secure network, which *solely* functioned inside of the taxi. Afterwards, the OOH-GP could access the MedWin system. The OOH-GPs described that a list of patients referred to home-based consultations appeared in MedWin together with a short description written by the OOH-GP who attended to the telephone consultation, which explained the reason for referral to a home-based consultation. One OOH-GP stressed that the descriptions written by the OOH-GPs handling the telephone consultations were helpful in order to prioritize patient order, and stated:

> "Normally, I will visit the patients in the chronological order that appears on the list, but since I have access to the whole 'visit-list,' I can prioritize patients on the basis of my colleague's description of the telephone consultation." [Interview, OOH-GP].

During the interviews, the OOH-GPs expressed that OOH-GPs in charge of telephone consultations could mark a home-based consultation as urgent, which resulted in the OOH-GP conducting home-based consultations prioritizing those marked as urgent before the non-urgent cases. This indicates that activities carried out during home-based consultations were supported by the information that was shared between the OOH-GPs conducting telephone consultations and the OOH-GPs performing home-based consultations.

Furthermore, an OOH-GP described that when managing home-based consultations, they were unable to bring a laptop to the patient's location, as MedWin could only be accessed in the taxi. To this, an OOH-GP expressed:

> "When I arrive on-scene with a patient, I do not have any electronic patient information with me. This means that I either have to remember crucial patient information or note it down on a piece of paper. The social security number is nice to have with me, in case the patient has to be hospitalized via EMS. If I don't have anything with me, I have to rely on my memory or depend on the patient having his/her social security number with them. I usually write things down on a piece of paper." [Interview, OOH-GP].

Regarding the above statement, the same OOH-GP explained the problem of non-available patient information on-scene, and how it caused challenges in the patient care process, since the OOH-GP was unable to look up the patient's social security number if the patient had to be hospitalized.

7.2.4 Supporting Healthcare Clinicians

It is essential to mention that Michael and James do not work directly with patients yet have an important role by providing IT systems and performing research that support healthcare and patient-related activities. During Michael's interview, he stressed that when developing, fixing, or upgrading

IT systems for healthcare systems, user needs were considered essential in providing important, useful, and needed information for the healthcare clinicians. He stated:

> "Listen, it might be true that they (in-hospital healthcare clinicians) need more information than what the Healthcare Record can provide. But then, then they have to speak up!" [Interview, Michael].

This statement indicates that in development or reformation of IT systems, Michael wanted to involve user needs. Furthermore, Michael expressed how workers at the IT and Digitalization office in the North Denmark Region provided 24 hour support to the OOH-GPs with software issues, telephone assistance, and more.

In James's interview, he explained how the Danish Health Data Authority was responsible for the implementation of the Common Medicine Card. James pointed out that the Common Medicine Card would be an assistive tool for the OOH-GPs and expressed how the information presented on the Common Medicine Card was beneficial. It provided the OOH-GPs with a list of what medicines a patient was prescribed, and using this information, James stated that the OOH-GPs were able to diagnose the patient. Furthermore, James described how facilitating projects concerning patient data sharing across healthcare settings revolved around researching how patients experienced the flow of information in the different healthcare sectors. Therefore, it was implied that providing IT systems deemed appropriate by healthcare clinicians was a priority.

Up to now, we have analysed the actors, activities, and movements involved in patient care. We found that healthcare clinicians working in EMS, EDs, and the OOH-GP utilize different EMR systems, such as the ePMR and MedWin, to support decision making and collaboration related to patient care. Furthermore, we have seen how movements to obtain information and prepare for patient contact could be considered movements towards reaching their common goal of enhancing patient care progress. From the interviews with Michael and James, we found that their activities revolve around creating and providing IT systems which support the healthcare clinicians in their performance of emergency care.

7.3 Organizational – Actors Involved

This study is comprised of many organized actors, including EMS clinicians, ED clinicians, OOH-GPs, Michael (IT and Digitalization expert in the North Denmark Region), and James (from the Danish Health Data Authority). The relationship amongst these actors is interdisciplinary and contributes different knowledge, attitudes, and perspectives to the organization. They all possess different competencies, which is essential in order to obtain the goal of an IT system that supports the enhancement of patient care progress.

We have found that the healthcare clinicians were supported by IT systems in their movements and activities when caring for and treating a patient. By including healthcare clinicians in the organization, it is possible to reveal their user-needs perspectives related to the development of IT systems. In the interviews with Michael and James, they have described technological, strategic, and political possibilities and obstacles regarding the development of IT systems for healthcare clinicians. The following section includes reflections on IT systems from the different organizational actors, which will be analysed and interpreted. These reflections represent solitary processes among actors that support developing and shaping shared IT systems in order to reach their common targets.

7.4 Process-driven – Processes to Efficiently Reach the Target

In our conceptualization of and work on utopia, we have found that processes towards systems considered to potentially support healthcare clinicians' work and movement towards the common target (*to shape a system that provides access to useful patient data to enhance patient care progress*) were reflected among the actors. To identify the concept of process-driven activities, we needed to involve participant reflections on how to best reach the common target. Reflections represent whatever the different actors consider themselves able to contribute in order to hone organizational processes and efficiently reach their common goal. We will therefore describe and present the actors' reflections on how to improve activities and processes related to the current EMR systems.

7.4.1 Sharpen Processes in the ePMR

While performing observations in the EMS setting, ambulance professionals expressed a general satisfaction with the ePMR – especially in relation to functionality and collaboration with the EDs. However, specific elements in the ePMR were identified as absent, poorly operational, or inadequately integrated. This was considered to affect the workflow in their clinical practice. For instance, it was observed, and many of the ambulance professionals described, that connections between the Defi and the ePMR were inadequate. In an ambulance, the Defi operates as a defibrillator and measures vital signs like blood pressure and electrical activity of the heart. While observing ambulance activity, one ambulance professional expressed:

> "It is desirable that the ePMR transfer the general patient data directly to the Defi, so that we don't have to manually type in the patient's civil registration number and name. Also, it seems a bit silly, since the ePMR first receives the vital data measured on the Defi, when you have to manually push the send button on the Defi." [Fieldnote, Ambulance professional, Evening shift].

Ambulance professionals described that vital signs were considered compulsory for interpreting patient condition, both in the ambulances and simultaneously in the ED, and the one-way connection between the Defi and the ePMR was considered a disruption in the ambulance professionals' work. Typing general information into the Defi was observed as time consuming, as expressed by the ambulance professionals. However, automatic data transfer from ePMR to the Defi was believed to be a way to improve this time consuming task per patient, and thus enhance the focus on patient care.

The observations made in ambulance ride-along revealed that the ambulance professionals reflected on how improved content in the ePMR could potentially increase patient progress. An issue identified within the ePMR, which the ambulance professionals frequently referenced, was the fact that the patient's medicine and allergy histories were poorly or not at all accessible in the ambulances. One ambulance professional described how he experienced and considered current access to medicine:

> "We have the ability to give some medicine in the ambulance, for example Fentanyl (a pain-reliever). However, we have no access to the patient's list of current medicine, which I find a bit odd [...]. Of course, we have to consult a doctor when in doubt, as they have access to this list of medication, but it would be nice to have the same availability in order to recognize possible contraindications." [Fieldnote, Ambulance professional, Day shift].

Furthermore, we were told (and we observed) that the ambulance professionals had to type allergies into the ePMR manually. Regarding this, the ambulance professionals expressed that in situations where the patient was unable to speak for him or herself, identifying potential allergies was difficult, especially if no relatives were present at the scene of the injury. Providing further information regarding patient medication and allergies in the ePMR was thought to be potential beneficial, especially in situations where ambulance professionals suspected that medicine given in the ambulance may result in side-effects, allergic reactions, or contraindications due to the patient's regular medicine. The ambulance professionals stressed that in these situations, they always communicated and consulted with emergency doctors via telephone. However, a list of patient medication and information regarding allergies could provide further interpretation of the patient and affect decision making, which ambulance professionals considered to potentially enhance patient outcomes and reduce medical errors. Furthermore, the ambulance professionals mentioned that local, regional instructions regarding procedures such as the resuscitation of children were difficult to physically access in the stretcher department. The instructions were integrated in a system on a supplementary tablet called Logis, which was located in the front of the ambulance. An ambulance professional expressed that integrating local instructions in the ePMR could potentially support more confident decision making.

The ambulance professionals' above-mentioned reflections indicate how changing elements within the ePMR could potentially enhance workflow, patient safety, and decision making. The elements

described embody processes that could be integrated into the ePMR, which, according to the ambulance professionals, would contribute to sharper work practices within the organization, higher efficiency, and movement towards patient-centered care.

Nevertheless, our observations revealed that the ambulance professionals did not only reflect on how improvements in the ePMR might enhance their own work practice, but also on how such improvements could help ED clinicians as well. For instance, an element in the ePMR called the injury-man (Figure 16), illustrates the location of a patient's injury or illness by pinpointing red dots on the injury-man. The ambulance professionals deemed this to be imprecise. Many ambulance professionals stressed that the injury-man could provide a valuable and quick picture of the patient's injury or illness for the ED clinicians. However, this would only be possible if they were able to pinpoint the exact site of the injury or illness on the injury-man with great detail. The ambulance professionals described that the size of the current pinpoints was too large and therefore made it difficult to interpret the precise location of the injury or illness. One ambulance professional expressed:

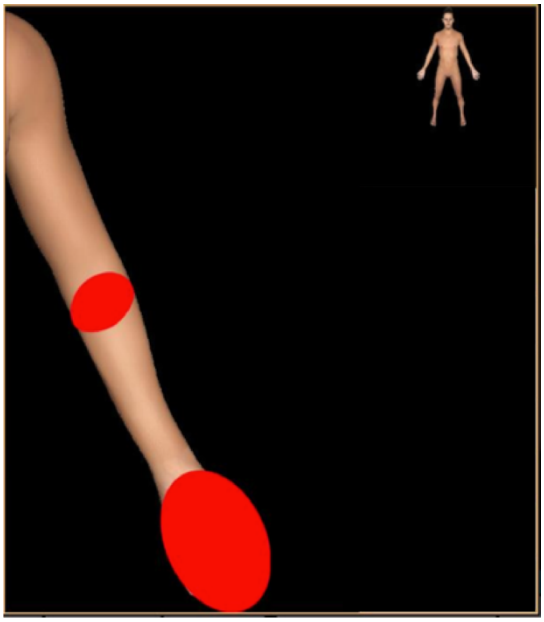


Figure 16: Visualization of the injury-man showing red dots pinpointing injuries on a 'patients' arm.

> "The injury-man needs to become either more precise or disappear from the ePMR. Currently, I cannot imagine that the ED clinicians find this information useful, and I don't think I have ever seen it actually being used in the ED." [Fieldnote, Ambulance professional, Night shift].

Another element considered by ambulance professionals to be a potential drawback in the ePMR was its camera's. Our observations in both the EMS and the ED revealed that pictures taken at the scene of the injury were then projected on a big screen in the ED's trauma room while clinicians were treating the patient. Some of the ambulance professionals questioned whether the poor-quality pictures were useful for the ED clinicians. The ambulance professionals particularly addressed that the pictures taken in the dark were rather useless, as the ePMR had no flash and the pictures turned

out black. ambulance professionals showed frequent curiosity and concerns regarding whether the information they passed on from their ambulances was considered useful and substantial to the ED clinicians. The reflections expressed by the ambulance professionals indicate a desire to sharpen processes not only in relation to their work, but also across healthcare settings in general, in order to improve patient progress and collaboration by improving the quality of ePMR information for the ED clinicians.

7.4.2 Involvement of Actors in Maintaining Systems

During our observation period in the ED, the clinicians expressed great satisfaction with the information available in the ePMR, as well as the data's structure when presented on the stationary ePMR screen in the ED's Core. However, the ED clinicians described that unfinished ePMRs challenged their ability to access the data of patients arriving by ambulance, and that it would be beneficial to find a way to finish ePMRs before patient arrival. Nevertheless, our observations revealed that processes facilitated by the ePMR supported clinical decision making in the ED, hence enhancing the patient care progress. This may indicate that the ePMR, as system, had been developed/improved through process-driven activities. Furthermore, an ED clinician described that both ambulance professionals and ED clinicians have had great impact in the development, content, and maintenance of the ePMR since its 2006 implementation in the North Denmark Region.

Also, during our ED observations, a coordinating nurse described that a council (of which she was member) was established in order to revise and evaluate the ePMR in EDs when it was implemented nationally. She explained that the members of the council – ED clinicians from all five regions in Denmark, as well as the private contractor of the ePMR system – would discuss content and pragmatic issues concerning the ePMR in EDs. The coordinating nurse described that it was difficult to agree at the beginning of the cooperation, and expressed:

> "We, in the North Denmark Region, were the first to use the ePMR in 2006, and when it was going to be implemented nationally in 2015, the council was established...We, in the North Denmark Region, met a lot of resistance from the other regions and they kind of refused to listen to our experiences using the ePMR – what works and what doesn't. So, we actually experienced some setbacks in the ePMR, because the other regions wanted to

> change it a lot, instead of listening to our experiences and suggestions. The setbacks were later corrected because, as it turned out, the changes did not work in practice. Funnily enough, this actually ended by returning to nearly the same version that we used here in the North Denmark Region before the nationwide implementation. It was frustrating because we could have saved some time if they had just listened. But now it works, and now we generate ideas together on how to improve the ePMR." [Fieldnote, ED clinician, Day shift].

The same coordinating nurse described that there was on-going implementation of new, small upgrades to the ePMR. For example, now a red exclamation mark appeared on the screen when the ED received a chat message from the ambulance professionals regarding a patient's arrival, which the ED considered essential in order to detect the messages. The history presented regarding collaborative difficulties at the beginning of the ePMR's nationwide implementation is an example of a process-driven activity that did not occur. As mentioned earlier, our observations in the ED revealed that the ePMR was central in patient coordination and management. Therefore, the coordinating nurses' frustrations about the ePMR's setbacks, which seemingly affected the ED clinicians' work at the time, was a result of changes in the ePMR that were decided by the council. The ED clinicians' knowledge of ePMR use in the North Denmark Region was neglected during the first evaluation of the ePMR. This resulted in a process that did not evolve around a common goal, but rather individual regional targets. The process demonstrated how actors inefficiently attempt to improve a common system without agreeing on a common goal and therefore fail to shape processes in a system that functions in practice. Nevertheless, it seems evident that maintaining the ePMR already entailed some process-driven activities, as ambulance professionals and ED clinicians contribute to and reflect on how to sharpen processes in the ePMR in order to efficiently enhance patient care progress.

7.4.3 Avoid Information-Overload

In our interviews with the OOH-GPs, they stated that they were pleased with the current system, MedWin, which provides no additional patient information besides a patient's earlier communications to/with the OOH-GP. The OOH-GPs described that they could access the Common Medicine Card and the Healthcare Record, but had to use other IT systems to do so. Still, throughout

the interviews we discussed potentially sharing patient information across healthcare settings as well as how the OOH-GPs would want information to appear in such a shared system. The interviews revealed a *common cautiousness* regarding the possibility of patient data sharing across healthcare settings. They considered their consultations with patients to be confidential and feared information-overload. In relation to sharing patient data across healthcare settings, the OOH-GPs expressed concerns about who would receive or could access detailed patient information and whether this particular information was to be considered relevant in the context it was received. Furthermore, sharing all patient data across healthcare settings was not considered advantageous in relation to the OOH-GPs' work tasks. One of the interviewed OOH-GPs described:

> "There are two issues present here. First is the confidential space and second is the fact that we drown in information. *If all data shared is unfiltered, right? Then we drown in information* [...] And I am a bit unsure where this data should come from. [...] I do not believe that someone is going to produce a concise note for the OOH-GPs. We could consider integrating discharge summaries that are less than a month old in the OOH-GP because these are short, after all." [Interview, OOH-GP].

The OOH-GPs felt that it was important to consider who should use resources to filter all the data within a potential shared system, and questioned who should decide which data and information would be relevant in each healthcare setting. Throughout the interviews with the OOH-GPs, it was thought that a system that could share data across healthcare settings should entail and include aggregated and structured data containing only the specific and relevant healthcare information about a patient. One OOH-GP described:

> "*It would be advantageous with a structured overview, hence aggregated data*. That would be preferable in contrast to have access to all sorts of data. It would not give me much advantage to have access to the EMRs in-hospital, because I do not have the time to go through all of those pages. The same applies for Sundhed.dk. But being provided with a structured overview of the patient, with the opportunity to access the latest blood sample results, would, on the other hand, be very beneficial." [Interview, OOH-GP].

During the interviews it became further evident that shared data across healthcare settings was considered to potentially support physicians' judgment when OOH-GPs performed home-based consultations. One OOH-GP described:

> "It is obvious that those who are most vulnerable, i.e. children, the elderly, and patients who are very ill, are often unable to answer for themselves [...] it is for those patients that we have the greatest need for access to information and the opportunity to prepare, especially during the drive when I am performing home-based consultations, I would be in a much better position to provide help more rapidly." [Interview, OOH-GP].

The OOH-GPs additionally articulated that the view of information in a system that shares data across healthcare settings should be created in a way that provides a fast overview, yet still has the ability to access additional information such diagnoses and hospital treatment. One OOH-GP described that three lines or less concerning a patient's hospitalization history would be desirable and provided an example:

> "The patient was hospitalized, OBS appendicitis, appendicitis confirmed, surgery was performed, and the patient was sent home in a state of well-being. That is all I need to know about that process." [Interview, OOH-GP].

The fear of information-overload and considerations of how to arrange the data in a way that prevents this from happening was frequently mentioned by the OOH-GPs. One OOH-GP described that potentially involving artificial intelligence in order to automatically handle all of the information received from other healthcare settings could be a way of working around the issue of data sharing and information-overload. The reflections presented regarding patient confidentiality and fear of information-overload could be an expression of sensitivity among the OOH-GPs to increased time per patient, as well as towards patient integrity. Hence, processes that evolve around developing and shaping a system to share data across healthcare settings were described by the OOH-GPs to ideally include the aforementioned aspects.

Throughout the interviews with the OOH-GPs, it became evident how systems in OOH-GP should entail aggregated, structured, and standardized patient information. A strong focus on avoiding information-overload was considered essential among the OOH-GPs.

7.4.4 Giving Patients Control of Data

In Michael's interview, he described that giving patients control of "their data" could be a way of managing what to share between healthcare settings. Michael expressed that deciding what patient data to share could potentially be accomplished within a system in which the very patient makes this decision. Upon entering the healthcare sector, the patient determines which parts of their healthcare data can be accessed by healthcare providers. Michael provided an example:

> "When a patient visits the dentist's office, the patient could manifest whether he or she wants the dentist to have access to his or her other healthcare-related data. For example, is the dentist allowed to access this – yes or no? And why not make a system with a swipe option, so that you, as a patient at the dentist's office, have the option to enter 'yes you can access data concerning me for the next hour,' swipe yes or no." [Interview, Michael].

Giving patients control of their healthcare data was described by Michael to potentially enhance self-determination. Furthermore, Michael recognized a tendency towards increasing digitization in healthcare, in which robots and artificial intelligence would be assisting healthcare providers in *doing*. Throughout the interview, Michael addressed that digitalization and technology in healthcare could assist healthcare providers in interpreting patient history by visualizing data, and he expressed:

> "It is very difficult for a human to look into a bucket filled with data and gain a complete overview. That would simply be hard to comprehend. However, that is what IT systems can provide. [...]. So, when it is possible for the IT systems to systematize data, then clinicians are able to deduce certain elements from this data [...] for example, poor health development among patients with chronic obstructive pulmonary disease, where the patient first reacts when they feel explicit exacerbation of health condition after three months. The nurse can see it faster (than the patient), but the computer – which reacts to tiny changes in data – is able to react more or less immediately." [Interview, Michael].

Michael recognized that nurses and doctors could detect symptoms quickly, however systems such as patient monitoring devices could respond to changes in patient condition more or less immediately, hence emphasizing the need for what Michael called *digital assistants*. In relation to the reflections stated above, this could indicate that digitalization and technology may potentially sharpen and improve processes within healthcare activities in order to become more efficient, as well as enhance work practices and patient outcomes. The reflections that Michael provided can contribute to the processes of achieving a system that moves towards the common target.

Additionally, reflections concerning ethical aspects of data sharing were shared during this interview. Michael expressed that responsible management of processes related to creating or maintaining digital assistants, EMR systems, and integrating artificial intelligence, would need further attention and prioritization. He stated that ethical considerations were not currently an obstacle for technological development or progress in healthcare; he found the rigorous approval processes very efficient at ensuring that digital development functions within ethical frameworks as well as preventing patient data leaks. Furthermore, a system that shares data across healthcare settings was not considered a technological hindrance by Michael. He mentioned that EMR systems could be visualized from many different platforms and it would be possible to design different interfaces for each healthcare setting based on the healthcare providers' particularly needs. In the interview, he explained that data from different healthcare settings could easily be woven together, by applying layers on the existing EMR systems. He expressed this to be a rather simple process, as all regions had platforms to which they could connect data across settings by using civil registration numbers, for example. While reflecting on the current divisions of the Danish healthcare system, he said the following:

> "This is where the three sectors want to meet each other, I think – sharing more, and it is an ironic situation we have: three healthcare sectors (primary, secondary, and GP) under one umbrella healthcare system, that are divided by law. *That is* a bit strange to me, and sometimes frustrating. [...]. However, you can come a long way by digitizing and providing information if it is needed." [Interview, Michael].

Michael endorsed that access to different EMRs within different levels and settings in the healthcare sector could be feasible and advantageous. However, Michael also addressed that healthcare professionals had to express what kind of data is considered desirable in practice, otherwise the change and movement towards a system that shares data across healthcare settings could not properly occur. The reflections and competencies Michael provided in relation to technically creating and deliver a system that shares data across healthcare settings, indicates that the technology was considered feasible, and that user-needs have to be considered in order to successfully shape a shared and useful system.

7.4.5 What is Relevant Data?

In James's interview, he revealed that he considers the development of a system that shares data across healthcare settings rather unrealistic. He doesn't feel that it is unrealistic in a technical sense, but rather in relation to finances and agreements regarding IT architecture among healthcare providers and authorities. He described that as long as the Danish healthcare sector was divided into different levels of authority, it would be challenging to agree on what system to implement. Furthermore, he considered that both authorities and healthcare providers would find it risky to manage one national, united system, as it would be very challenging to replace the EMR systems already established in different healthcare settings. He emphasized that within his workplace, the Danish Health Data Authority, they were not against enhancing the IT landscape, however, he considered that sharing patient data across healthcare settings would be a challenge and he expressed the following:

> "We often come to discuss what is necessary to share. What I mean is: does the municipality have a different need for information than the hospital, and what then is relevant to share between the hospital and municipality?" [Interview, James].

James thought that sharing only *relevant* data would be challenging, as someone would have to decide what is considered *relevant* in each healthcare setting, someone would need to approve the coverage of the financial expenses, an agreement would need to be reached regarding IT architecture as well as standardization. He recognized that healthcare providers desired layers of other systems that went as deep as possible into their existing EMR systems, as they wanted to avoid changing sites or having to log on to more than one system. However, building systems alongside other EMR systems, which

could unite the EMR systems by a layer, was not something in which James. He reflected and estimated that processes in clinical practices could potentially benefit from making relevant patient information available for healthcare providers. He expressed the following:

> "Well alternatively, they (the clinicians) do it (carry out the treatment of patients) blindly. If the information were available somewhere, but were just inaccessible – then I think there might be a risk for errors, if you don't have that information." [Interview, James].

Throughout the interview he described a project that was developed in collaboration with patients, aimed at providing a general patient overview across healthcare settings, e.g. basic information concerning a patient and healthcare-related appointments. He believed that the project, and making this information available to healthcare providers, could enhance clinical work. In relation to this, he described that the project had been streamlining processes of transporting elderly citizens to their appointment at hospitals, since municipality nurses had access to appointments and could therefore prepare the drive. Furthermore, James emphasized that giving the patient control of their healthcare data was considered as essential as sharing patient data across healthcare settings. In the interview he revealed that he had experiences with, and reflected upon, sharing data across healthcare settings. This would require considerations towards the healthcare sector and the recognition that healthcare settings are different from one another. For instance, in GP, the patient-doctor relationship was rather different from the patient-doctor relationship in-hospital, and James identified that the confidential space in GP could be challenging in relation to sharing data across healthcare settings. Furthermore, it was revealed that sharing patient data across healthcare settings and the processes around shaping IT systems would also be a challenging and somewhat unrealistic task – in relation to agreement among the authorities, determining what data is relevant within different healthcare settings, creating an IT architecture that includes the existing EMR systems, and maintaining a patient-centered mindset. Hence, James's reflections upon how the target can best be reached are rather complex. However, he emphasized that including the patient in the debate concerning what data to share was central in order to share patient data at all.

7.5 Interrelated - Sharpening Processes Towards the Common Target

In our empirical data, we found that some processes were highly interrelated. Furthermore, the processes which were identified as interrelated, moved towards reaching the common goal. In order to identify the category of interrelated, we need to look at the processes, which were reflected on above by the actors within the created organization. The reflections expressed represent processes that contribute to how the actors believe they can efficiently reach the common target. In the following section we will present shared reflections among the actors – how these are or could become interrelated – and thus move towards the common target.

Our observations in the EMS and the ED, together with the reflections presented expressed by the ambulance professionals and ED clinicians in section 7.4 [Process-driven], indicate that processes within the EMS and ED settings were already interrelated. The ePMR facilitated a common platform in which information could be shared, indicating an interrelation as knowledge flowed between the settings through the ePMR and was considered helpful for decision making in clinical practice. For instance, the collaboration and handover of patients were supported by the content in ePMR, which assisted in preparing medical teams for trauma patient arrival and managing patient flow in the ED. In order to reach the common goal of improving health conditions, some reflections on improvements were articulated. For example, the ambulance professionals expressed that processes that included more access to medicine lists, allergy registries, and local instructions, could potentially enhance clinical performance in the ambulances, hence increasing patient outcomes. These processes can become interrelated in more than one sense. The processes can become technologically interrelated; for example, the ePMR can be connected to the Common Medicine Card, which provides medical information for all patients with a Danish civil registry number, and processes can become interrelated between work practices. In the sense of interrelation between work practices, we address that sharing data provides a shared foundation, as ambulance professionals would have the same information about medicine lists as the prehospital anaesthesiologist, from who they are seeking advice – was identified as potentially supporting confident decision making among the ambulance professionals.

From our empirical data in the ED, we found that processes must be interrelated in order to successfully achieve collaboration across healthcare settings. The findings became apparent within our observations from the ED, which, as mentioned earlier, showed difficulties in the first stages of

collaborating within the Council of ED clinicians from all five regions, as well as software engineers, towards improvement of the ePMR. The different actors worked from their own perspectives without listening and integrating the other actors' reflections, which resulted in drawbacks within the ePMR system. We state that interaction between different actors in the created organization can be advantageous in order to create dialogue concerning the common goal and which processes reaching this target should entail.

In this thesis, we have set out to study how digitalization and sharing patient data across three Danish out-of-hours healthcare services can support clinical workflow and practice. As presented, the ePMR already facilitated interrelated processes of shared data between the EMS and the ED. However, the OOH-GPs were identified as being excluded from the EMS and the ED – both technologically and physically. In relation to this, the OOH-GPs expressed caution within their reflections upon sharing data across healthcare settings. Reflections articulated by the OOH-GPs represented concerns about information-overload and violating patient confidentiality. However, the OOH-GPs acknowledged that processes which included aggregated, structured, and standardized patient information shared across healthcare settings could potentially support consultation preparation. In line with the reflections expressed by the OOH-GPs, both Michael and James shared common reflections. James addressed issues of how to define relevant data, where the patient was identified as an important actor to involve. Likewise, Michael identified that providing the patient with control of their data could potentially solve issues of what to share and with whom. By bringing the reflections of the OOH-GPs together with Michael and James's reflections, we will state that processes concerning the issue of what to share is highly relevant to interrelation. This is because the concerns of technologically protecting patient integrity, information-overload, as well as desires for aggregated, structured, and standardized shared data among the OOH-GPs, were all articulated with technical solutions by Michael and James. Designing views that were considered appropriate for the given healthcare setting was not expressed to be problematic. However, challenges in agreeing on authority levels on how to share patient data, as James addressed earlier, was identified to be a potential difficulty in order to shape a system that shares patient data across healthcare settings. Interrelating these processes could result in a dialogue and interaction between involved actors that moves towards an architecture that shapes a shared system – and thereby reaches a common target: *to shape a system that provides access to useful patient data to enhance patient care progress*.

7.6 Architecture - Shaping the System

The final part of our conceptualization is *architecture*. The common target: *to shape a system that provides access to useful patient data, hence, to enhance patient care progress* is presented as a depiction of utopia i.e. *the end result*. From the empirical data combined with the analysis above, we will present how the architecture of a system, which shares data across healthcare settings within the three Danish out-of-hours healthcare systems could be visualized.

Throughout the interviews with Michael and James it became evident that sharing patient data was technologically possible. Michael described that digital layers could efficiently connect EMR systems across healthcare settings and considered it a simple technological task. Among the observed and interviewed healthcare professionals i.e. ambulance professionals, ED clinicians, and OOH-GPs, access to aggregated, structured, and standardized patient information was considered essential within a system which shares data across healthcare settings. Through the analysis and empirical studies, we identified that the ePMR already facilitate a system that provides access to, and an overview of useful patient data i.e. aggregated, structured, and standardized patient information. Furthermore, the ePMR supports collaboration between settings by sharing data, which indicates that the ePMR comply with utopia. However, sharing patient data with OOH-GP is still absent. All healthcare professionals included in this study expressed concrete examples towards what a system, which share patient data across healthcare settings, should include.

For instance, one OOH-GP considered video consultations to potentially enable faster consultations, allowing OOH-GPs to assess patients while they are at home. Thus, avoiding unnecessary physical consultations at the OOH-GP and saving time. An OOH-GP gave an example:

> "A first-time mother needs advice for her sick child and she calls the OOH-GP because she is worried. This is a situation in which I would like to have a video consultation so that I can see the mother and the child [...]. It would be an additional tool for me to make a better overall assessment." [Interview, OOH-GP].

Moreover, the OOH-GPs expressed that additional paraclinical information, such as electrocardiography (ECG) and blood samples, would be advantageous to integrating or sharing data in system across healthcare settings. Similarly, the ambulance professionals addressed frustration

towards information absent in the ePMRs concerning a patient's medicine, allergies, and local instructions. Access to this information was associated with increased confident decision making. They furthermore stressed integrating face-recognition into the ePMR and how that could potentially reduce time used to log on in the ambulances.

During the interview with Michael it became evident that it was possible to extend the system and hereby connect all of the existing EMR systems e.g. connecting MedWin, ePMR, and in-hospital EMRs. The OOH-GPs described that the design of such a system could include blocks in their current system (MedWin), paraclinical measurements such as blood samples, and patient history generated in different settings. The blocks should be accessible on the front screen and in order to gather further information, the clinicians would have the opportunity to click further into the blocks containing additional patient-specific information. The blocks on the frontpage would contain basic patient data similar to the current system, such as patient name, age, sex, Danish civil registration number, etc. Information regarding earlier visits to the OOH-GP was also considered relevant among the OOH-GPs. However, the front page of the system would include individual blocks that represented each healthcare setting; i.e. a block containing patient information in the municipality setting, a block covering data generated in the hospital, a block comprised of OOH-GP data, etc. The described interface is considered advantageous among OOH-GP. Nevertheless, our findings concerning data availability in EMS and ED indicate that such interface would not benefit their work practice. Throughout our observations in EMS and ED combined with the interviews with OOH-GPs, James and Michael, we discovered that a shared system presupposes that interfaces within the different healthcare settings ought to be presented differently depending on user needs. Hence, a shared system within the three Danish out-of-hours healthcare settings should not be homogeneous and identical. Figure 17 below illustrates a shared EMR system visualized with basis in OOH-GPs perspectives and descriptions.

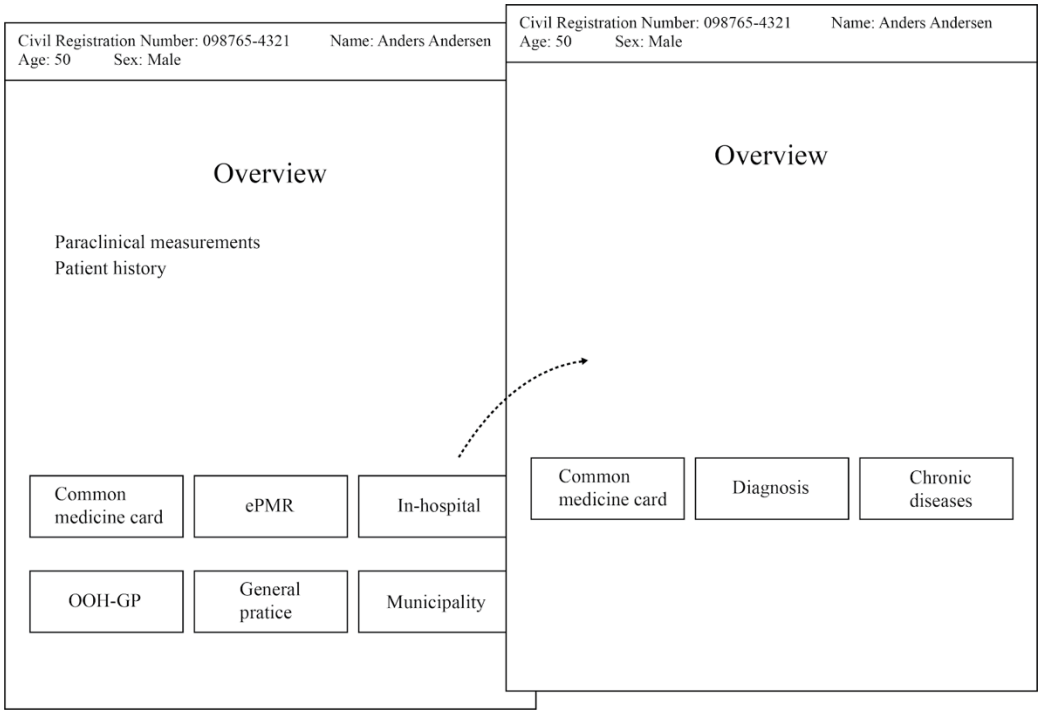


Figure 17: Example of architecture of a potential shared system across the Danish healthcare setting - visualized from an out-of-hours general practitioners' point of view (Authors creation).

All participants within the three Danish out-of-hours healthcare services described how access to patient data from the entire healthcare setting could benefit the progress of patient care, even though displaying solely aggregated, structured, and standardized patient data. Multiple elements would have to be considered in order to make such a system, that should/could support all healthcare actors providing care for patients.

Until now, we have through our performed observations and interviews, analysed on how EMS clinicians and ED clinicians acts around/utilizes EMRs, and on how the OOH-GPs describe their usage of MedWin. In relation to the three settings, we have analysed on EMRs role in clinical practices. Furthermore, we have found how Michael and James describes possibilities and challenges in relation to the presented problem statement concerning data availability and potentially sharing across health care settings. With basis in these findings - and in the other findings from the analysis above - we find it relevant to discuss whether the EMRs included in this study are boundary objects, as we preliminary interpreted them to be so, and as we now have analysed on their role throughout the three Danish out-of-hours health care services settings. Furthermore, we will debate if the health care actors can avoid information-overload as well as how solely relevant patient data can be presented in relation to clinical reasoning and preparation in order of providing the best patient care.

8.0 Discussion

In this thesis, we set out to study *how the healthcare clinicians working in the three out-of-hours healthcare services experience current patient data availability as well as describe potential sharing of patient data across healthcare settings*. We have stated that we preliminary interpreted EMRs to be boundary objects, and in relation to the generated empirical material, we find it relevant to discuss whether this proves to be correct. Furthermore, using our utopia analysis, we have found aspects of how the involved healthcare clinicians experience and describe current and potential data availability. In relation to this, we find it relevant to discuss the impact and role of EMRs in the field of emergency medicine, and how our findings contribute to the scientific debate within this field.

8.1 Are EMRs Boundary Objects?

Star and Griesemer (1989) argued that a boundary object is plastic enough to adapt to local needs, yet robust enough to maintain a common identity across sites. We have previously presented how we first interpreted Danish EMRs as boundary objects, as they could support local needs but still facilitate a common identity as "information-sharers" across the three out-of-hours healthcare services. However, our findings in subsection 7.4.3 [Process-driven] showed that the OOH-GPs experienced that structured patient information from other healthcare settings, visualized in MedWin, could improve decision making. This, together with the findings in subsection 7.2.2 [Towards] regarding ED clinicians' use of information provided by EMS clinicians through ePMR, in order to prepare for patient arrival, as well as the findings in subsection 7.4.1 [Process-driven] concerning EMS clinicians' collaborative experiences with the ED, we find it exceedingly relevant to debate whether Danish EMRs actually meet the criteria of a boundary object.

In the previously presented study by Christensen and Grimsmo (2008), it was stated how the first EMR in Norwegian GPs were implemented in 1979. By 2008, documentation was almost entirely electronic. Furthermore, they found how primary care clinicians were generally pleased with the EMR systems, albeit with room for improvement (ibid.). Availability of information was considered unsatisfying in relation to supporting dialogue with other healthcare clinicians through EMRs as well as lack of integration of EMR systems within other healthcare settings (ibid.). With the information provided in the study by Christensen and Grimsmo, we are not capable of identifying and discussing

the Norwegian EMR as a boundary object, as we can only identify the EMR as being plastic enough to adapt to the local needs, and are unaware of the perception of EMRs from other social worlds, hence different healthcare settings.

Going beyond Christensen and Grimsmo, in this master's thesis we have found experiences and descriptions of the Danish EMRs from across a variety of healthcare settings. In our findings, we have shown how EMS and ED clinicians experience the ePMR and how OOH-GPs describe data availability in the Danish EMRs. We found that the ePMR was described as assistive tool for collaboration between EMS and ED clinicians, which could indicate that the ePMR is appropriate as a boundary object.

We stressed that the ED clinicians are pleased with the overview provided by the ePMR on the stationary screen located in the Core. Yet, ED clinicians expressed how the availability of more information prior to patient arrival via ambulance could enhance patient care progress. We will argue that the ePMR is plastic enough to adapt to the ED environment, as it is strongly structured to the ED clinician's usage, providing the needed information overview in the somehow chaotic workflow of the ED. Additionally, we have shown how the EMS clinicians are overall satisfied with the ePMR, as they can carry it with them to the scene of the injury and how it facilitates a checklist both when providing patient treatment in an ambulance and when handing the patient over to ED. With this basis, we consider the ePMR to be highly adaptable to the EMS clinicians' work within the field of emergency medicine. Both EMS and ED clinicians have described how the ePMR has facilitated more collaboration across settings. We can argue that the ePMR is robust enough to maintain a common identity as an object for "information-sharing." In fact, the ePMR is well-functioning for its purpose, and the EMS and ED clinicians have a general and common understanding of the ePMR. Both EMS and ED clinicians have pointed towards elements in the ePMR which could be improved: ED clinicians suggest more data availability before a patient's arrival to the ED, and EMS personnel suggest being able to provide more precise information in the ePMR. We identify a common understanding among both EMS and ED clinicians performing emergency medicine, and an acceptance of prioritizing, clarifying the injury or illness, and treating patients before documenting or reading the ePMR. In light of the above, the ePMR – being locally plastic, yet commonly robust, is an exemplary boundary object enabling clinicians to collaborate. The ePMR is considered as a successful integrated infrastructure across settings by the involved EMS and ED clinicians, as it

enhances their way of preparing for patients and sharing information. Therefore, we identify the ePMR as an advantageous asset in relation to a patient's total care progress.

Nonetheless, our preliminary interpretation of EMRs as a boundary object within the three out-of-hours healthcare services has been challenged by OOH-GP experiences of utilizing MedWin. Lindskou et al. (2019) and Huibers et al. (2014) presented how OOH-GPs are considered gatekeepers to hospitals in relation to out-of-hours healthcare services, as they can refer patients to the hospital while handling, together with the EMCC, the 1.3 million contacts to out-of-hours healthcare services (Lindskou et al., 2019; Huibers et al., 2014; Mackenhaur, 2017). However, in this study we found how patient information documented by the OOH-GPs in the EMR called MedWin has restrictions in relation to sharing and accessing patient data. As presented, the OOH-GPs can refer patients to EDs, but the only information that is transferred and available to the ED clinicians is a "referral-note." Furthermore, OOH-GPs have described MedWin as unable to facilitate direct communication to refer an ambulance to patients, which explains the contact with EMCC, as they had to use their own telephones. Additionally, we will state that the OOH-GPs operate rather independently from the remaining healthcare settings (EMS and ED) within the three out-of-hours healthcare services, as OOH-GP perform treatment of less urgently injured or ill patients compared to the EMS and the ED, and the OOH-GPs are also able to carry out a complete patient care progress without involving the EMS and/or the ED. Therefore, we will identify the OOH-GP as being a hybrid between GP and emergency medical care. The only support allowing collaboration between OOH-GPs and EMS/ED we have identified, is referrals from OOH-GPs to the ED and EMS. We argue that this is a *one-way-collaboration,* and MedWin is adapted to the local needs of OOH-GPs, yet does not facilitate a common identity between the three out-of-hours healthcare services. Thereby, we judge MedWin as an EMR incapable of being a boundary object.

Nevertheless, it is relevant to acknowledge the OOH-GPs expression of overall satisfaction with their EMR, yet note that there is room for improvement. The OOH-GPs number one priority is treatment of the acutely injured or ill patient and the most important information available is provided verbally by the patient himself – not from EMRs. In our UTOPIA analytical framework we have presented how the OOH-GPs desire a need for greater patient data availability if certain elements could be incorporated, which is an argument in favor of considering the EMR utilized in OOH-GP as an object with the potential to be made into a boundary object like the ePMR.

8.2 Available Patient Data for Clinical Decision Making

Until now, we have discussed how the ePMR is a boundary object and that MedWin is incapable of being one given how it is currently used. In subsection 7.1.3 [United], we have shown the shared target among the actors providing out-of-hours healthcare – which is providing care and improving patient's health conditions, and in the following section we will discuss whether EMRs have any impact on reaching this target. Furthermore, in subsections 7.2.1 [Towards], 7.2.2 [Towards], and 7.2.3 [Towards] we have shown how data is available and utilized in different settings for clinical reasoning and preparation. With basis in this, we find it interesting to put into perspective how EMRs impact or could impact clinical reasoning while performing patient treatment.

Balla et al. (2012) discussed how lack of access to background information on patients from their medical records caused issues in treatment. Furthermore, they found it difficult to define pertinent issues among elderly patients with complex multisystem chronic diseases due to presentation of information in EMRs (ibid.). We have shown that it is essential that data follows the patients, especially in relation to elderly citizens and chronic patients, which aligns with the issues discussed by Balla et al. (ibid.). However, we have observed how patient data does not always follow the patient, for example, in the ED. Poor facilitation of patient information was especially present with trauma patients as the EMS clinicians did not document data in the ePMR, and data available within the in-hospital EMR was unstructured and difficult to navigate in order to obtain the most pertinent information. This poor facilitation of data could seemingly have consequences for clinical decision making in relation to the care of trauma patients in the ED. On the one hand, we identify poor facilitation of patient information as a major obstacle for the actors providing out-of-hours healthcare services, as it to some extent prevents them from moving towards their target of *providing care, saving lives, helping the patient, and improving patient health conditions* for emergency patients. Yet, on the other hand, we question if better facilitation would improve patient care when treating a trauma patient, as the urgency of the patient's illness or injury requires immediate treatment and there is no time for clinicians to access the patient's EMR beforehand. Even though the ED clinicians specifically advocated for better access in all patient situations, we will argue that this need of greater access is context-dependent, which is a result of working within the field of emergency medicine, just like Balla et al. suggested in their study (ibid.).

In relation to available patient information, Andersson et al. (2019) and Norri-Sederholm et al. (2015) found that EMS clinicians' clinical reasoning before arriving on-scene by patient enabled them to calculate which equipment to carry along, the potential risks awaiting them, and how EMS clinicians communicated actively across settings, such as with the police in multi-authority incidents. However, both studies pointed to a need of examining the information flow across settings, in order to enable a greater understanding of required information, which we argue we have contributed to within the Danish context, as we have uncovered how the information is being shared across healthcare settings, yet restricted to the out-of-hours healthcare setting (Andersson et al., 2019; Norri-Sederholm et al., 2015). We found how some data is available across settings, which is applied for clinical reasoning and preparation: EMS clinicians using EMCC messages, ED clinicians utilizing the ePMR overview, and the OOH-GP carrying out home-base consultations based on information from the OOH-GP who assessed the patient by telephone. Furthermore, we found how the prominent actors from IT and Digitalization in the North Denmark Region and from the Danish Health Data Authority identified data availability having feasible circumstances.

Nonetheless, we point to how the present circumstances of data availability for the OOH-GP performing home-based consultations could benefit greatly by implementing an already existing technology. We will suspect that OOH-GPs carrying out home-based consultations could advance from having a tablet computer as assistive tool, just as the EMS clinicians have the ePMR on a tablet computer. In this way, OOH-GPs could carry MedWin along when assessing a patient during a home-based consultation, and access patient information on-scene. Therefore, we criticize the present data availability in relation to OOH-GPs at home-based consultations. On the basis of our findings, we strongly advocate for increased patient data availability on-scene through an assistive tool, which could contribute to the enhancement of patient care performed during home-based consultations, as OOH-GPs would have more information available for clinical reasoning in relation to decision making.

For clinical reasoning on behalf of patient data, it is important that the available data is embedded by quality. Poulsen et al. (2020) found how quality of registration of vital signs in ePMRs increased gradually after implementation in the North Denmark Region in 2006, then decreased after the nationwide implementation in 2015, and increased again from 2016 forward. We reason this increase/decrease is a reflection of implementing a new technology for EMS clinicians. One can assume that implementing a tablet computer in OOH-GP will have similar consequences in relation

to quality of documentation. However, in our study, we did not find the quality of vital signs as a crucial issue among the involved actors. We argue that the most pertinent patient data should be the center of rotation in relation to clinical decision making, as it enhances overview and relevance of patient information available for healthcare clinicians. Nevertheless, we state that quality is important as well, otherwise reasoning of the documented data in the overview would be rather resource demanding.

8.3 Sharing Information across Healthcare Settings Assisting Handover

In the section above, we have reflected upon and argued that data availability within EMRs has impact on clinical reasoning and preparation. In subsection 7.2.1 [Towards] and 7.2.2 [Towards] we have shown that EMS and ED clinicians utilize ePMRs in relation to verbal and written handovers, and in subsection 7.2.3 [Towards], how OOH-GPs use internal referrals during home-based consultations. In the following section we will discuss if and how data availability has an impact on and can assist in patient handover across the three Danish out-of-hours healthcare services.

In the previously presented study by Knutsen and Fredriksen (2013), it was identified that ED clinicians preferred verbal handover over written and appreciated consultation with other doctors/specialists over information attained during a verbal handover from EMS clinicians. Yet, the authors of the study stressed that losing written EMS medical records had the potential of risking continuity of care as well as losing important information (ibid.). Still, the presented findings in subsection 7.2.2 [Towards] in this thesis suggest that ED clinicians used the information available on the stationary computer containing the ePMR overview in order to manage patient flow in the ED, and to assist during the verbal handover in the ED by EMS clinicians. Furthermore, the ePMR facilitated preparation for patient arrival, as patient data, such as vital signs and pictures, were shared simultaneously across EMS and ED settings, which assisted the ED clinicians to gather and activate the right specialized team prior to patient arrival.

The previously mentioned Danish study by Raaber et al. (2016) found that a geographical information system, which provided information regarding estimated time of arrival, was experienced by ED clinicians to provide helpful and accurate estimated time of arrival prior to a patient arriving with the EMS at the ED. Furthermore, the study pointed to reduced waiting times for activated trauma teams or medical emergency teams prior to patient arrival in the ED, after the implementation of electronically shared estimated time of arrival between the EMS and ED (ibid.). In relation to this,

our findings suggest that written handover in the ED was considered valuable and useful, however limited as the EMS clinicians rarely were able to finish the ePMR documentation before arrival. From this, together with the findings from the study conducted by Raaber et al. (2016), we will state that access to written information in the ED is important in order to provide ED clinicians with an overview of patient care progress prior to arrival.

Likewise, other studies point towards written handovers as an important supplement to verbal handovers in EDs and furthermore, that a written handover can avoid losing important clinical information, which is essential in order to improve emergency care (Shelton and Sinclair, 2016; Harmsen et al., 2017). Yet, a study conducted by Owen et al. (2009) found that handovers between EMS and ED settings were reflected to be a frustrating process. The participants in the study –EMS and ED clinicians – expressed difficulty in conveying and receiving verbal handovers, which resulted in diverse cognitive pictures (ibid.). In the study, the authors found that there were discrepancies in relation to responsibilities of the receiving staff, such as addressing/treating the patient immediately during handover, and active listening towards the verbal handover provided by EMS clinicians (ibid.) It was found that a need for shared understanding between EMS and ED clinicians was present, which was suggested to be achieved by shared experiences through simulated scenarios or interdisciplinary education (ibid.). On the contrary, the findings in subsection 7.2.2 [Towards] in this thesis suggest that the ED clinicians, such as the coordinating nurses, appreciated the verbal handover from the ambulance professionals. We presented earlier how the coordinating nurse in the ED was standing in the Core, and how he/she would look at the ePMR on the stationary computer whilst receiving verbal information from the ambulance professionals, and the ambulance professionals would likewise use the ePMR in the mobile tablet computer as a checklist while conveying verbal handover. This indicated that the information available in the ePMR shaped a shared understanding between EMS and ED clinicians, which benefited the verbal handover and therefore also the patient care progress. Nevertheless, verbal handover between clinicians in the three out-of-hour healthcare services was solely found to be present between the EMS and the ED, however, written handover from OOH-GP "referral-notes," was sent electronically when referring patients from the OOH-GP to the ED.

In the earlier study by Skelton et al. (2019), findings regarding a need for a standardized electronic handover system after hours was identified, and these were associated with reduced number of medical errors. We do not have empirical data to confirm nor reject whether "referral-notes" from OOH-GPs to the ED have an impact on medical errors in the ED, yet our findings showed that the

"referral-notes" were utilized for preparing to attend to patients referred by OOH-GPs. Our findings in subsection 7.2.3 [Towards], however, suggested that referral occurred internally within the OOH-GP, as patients were referred to consultations and home-based consultations. Even though the OOH-GPs reflected that time spent in front of the computer was time-consuming as well as time taken away from the patient, documentation provided by the telephone consultations of OOH-GP was considered supportive prior to arrival at a home-based OOH-GPs consultation.

From the above we will state that handovers containing written information support the interpretation of the patient, prior to patient contact in both the ED and for OOH-GPs performing home-based consultations. Our findings imply that the EMRs used in the EMS, ED and OOH-GP represent digital assistants, which we have earlier defined as digital supporters that facilitate creating an overview of a great number of data, which would be impossible for a human to do. In line with our findings, we have, as mentioned earlier in this section, found that ED clinicians and ambulance professionals utilize the ePMR while performing verbal handovers, which evidently helps them to overcome the information conveyed and received verbally. Yet, it is interesting that our findings point towards constraints among OOH-GPs in relation to the achievement of access to more patient data, which was expressed to be reasoned in fear of information-overload, violating patient confidentiality, and satisfaction with the amount and content of data already available in MedWin. However, we argue that OOH-GPs could benefit from more patient data access.

8.4 Shaping a Useful Shared System Containing Relevant Data

By this point, we have argued that more data availability would enhance performing patient treatment in all three out-of-hours healthcare services. We found in subsection 7.4 how the involved actors have described elements that should be included in a shared system. In relation to this, we find it essential to reflect on how relevant patient data can be presented and visualized in such a shared system, as well as discuss how information-overload can be avoided.

In this study, we have presented the study conducted by Hall et al. (2017) where it addressed that sharing patient information across healthcare settings could benefit patient care progress and prevent unnecessary hospitalization. Furthermore, the findings presented in the study by Staff and Søvik (2011) described how standardized uniform medical records could result in improved emergency care. Yet, in a study by Christensen and Grimsmo (2008) it was emphasized that attaining information

in EMRs in GP was considered time-consuming and the healthcare clinicians expressed the desire for timely and adequate information access, in order to avoid information-overload.

Our findings in subsection 7.4.3 [Process-driven] likewise point to a desire for avoiding information-overload. The OOH-GPs expressed that sharing *all patient data* would be disadvantageous and sharing data across healthcare settings should rather entail *aggregated, structured, and standardized* patient data that facilitate patient overview. Furthermore, we will argue that the ePMR represents a shared system between the EMS and ED settings, in which structured patient data flow in relation to the healthcare clinicians' particular needs, such as the mobility of the ePMR in the EMS allows the ambulance professionals to carry the ePMR with them on-scene, and the well-structured overview in the stationary computer with ePMR provides a decent overview which supports decision making in the ED. Our findings show that the OOH-GPs were well-reflected towards potentially shaping a system that shares patient data across all Danish healthcare settings, and both the OOH-GPs and James emphasized that only *relevant* data should be shared within such a system. However, our analysis of our findings does not provide a clear depiction of what relevant data is, and – more importantly – who decides what data is relevant?

Once again, we will turn to Star and Griesemer (1989) and their concept of boundary objects. Furthermore, a boundary object has the ability to obtain diverse meanings for different actors in different social worlds, while concurrently holding commonality between the social worlds (ibid.). We will argue that *relevant patient data* is the substance of what some of the involved actors identify as significant within a shared system, yet also consider dissimilar, which we identified in subsection 7.4.3 [Process-driven] and 7.4.5 [Process-driven]. Hereby, relevant patient data has diverse meanings for the different actors which includes their different needs for how data is visualized in their different social worlds. For instance, OOH-GPs expressed that accessibility to healthcare medical records in-hospital could be advantageous, yet the EMS clinicians did not articulate the same particular desire, but requested access to the Common Medicine Card. James addressed challenges that lay within determining what the different healthcare settings define as relevant data and he points to clarifying user needs, i.e. what information does the municipality need? From the above, we will argue that relevant data is the plastic material that can be formed into the needs of the individual social worlds, yet is robust enough to contain a shared identity, hence, a common system being shaped as a boundary object across healthcare settings.

Nevertheless, James considered creating a system that shares patient data across healthcare settings as a rather unrealistic task in relation to authority agreement, finances, and IT architecture, since creating a new system was associated with risks threatening the existing EMR systems. Additionally, with our knowledge on how user involvement in relation to the development of the ePMR was applied, we will reflect that user involvement in relation to development of a shared system is to be presumed advantageous as the system would withhold aspects suggested by the users. Moreover, we have presented that Michael believed that it would be technically achievable to develop a shared system, for instance, by integrating layers as well as artificial intelligence. So we question, can artificial intelligence be a solution towards shaping a system that shares solely *relevant patient information*?

We will again turn to the boundary objects concept, yet with a foundation in the study carried out by Bossen et al. (2013) and their interpretation of managing boundary objects. In the study, it has been argued that: as long as coherence within the different intersecting social worlds is maintained, boundary objects can have stabilizing effects in collaborative activities, and they suggest the name 'boundary object trimming' for the maintenance of boundary objects (ibid.).

How to maintain coherence between the different social worlds and trimming the boundary object, as we have identified the potential shared system to ideally become, is difficult to comprehend. Artificial intelligence could support shaping relevant data in such a shared system. The functionality that lies within artificial intelligence can be a way to avoid information-overload in EMRs by prioritizing certain information above others in relation to the healthcare actor employing the EMR. In this way, the healthcare actor would be provided with the content of information pertinent for the given patient treatment/care. Michael expressed in subsection 7.4.4 [Process-driven], and we argue, that artificial intelligence could potentially become the object that trims data in order to visualize solely relevant data in each social world that employs the boundary object: the useful shared system. However, in relation to a shared system, some of the actors involved also expressed that patient confidentiality was essential to consider in shaping such a system. For instance, Michael suggested that you give patients control over "their data," hence the data available for healthcare clinicians is the data that the patient has approved to become accessible. Nevertheless, we will argue that combining the three elements (the users) in the three out-of-hours medical services, artificial intelligence, and the patients in revealing what *is* relevant data, could be a way of deciding which data should be shared across healthcare settings.

The UTOPIA framework we derived through our study provide answers to the question of how healthcare clinicians in the three out-of-hours healthcare services experience current data availability, yet also describes concrete and abstract elements that a potential shared system should entail. In the discussion, we argued how the connection with a shared utopia system in relation to shaping such system should facilitate 1) collaboration between the involved actors, 2) handover between healthcare settings, 3) decision making - and 4) overall considered useful among actors in different social worlds. To this end, we will argue that artificial intelligence is beneficial, as it can include all the desired elements identified by the users within a shared system. This will result in avoiding information-overload and solely providing pertinent patient data. Overall, with our concept of utopia and discussion hereof, we have clarified how a useful shared system can be a significant asset in relation to the patient care progress.

9.0 Conclusion

In following, we will conclude on the thesis statement: *How does healthcare professionals working in the three out-of-hours healthcare services experience the current patient data availability as well as describe potential data sharing across healthcare settings?*

Our analysis revealed divided opinions in relation to current patient data availability from participants within the three Danish out-of-hours healthcare services. The EMS- and ED clinicians express overall satisfaction with the ePMR interfaces. The ePMR is considered as an assistive tool since it supports collaboration between the EMS and ED settings, through simultaneously sharing patient data. The EMS clinicians points out how ePMR assists as a checklist, both when performing treatment of patients and handing over patient in ED. The ED clinicians identify the ePMR as a supportive overview in relation to management of patient flow and preparation for patient arrival in ED. However, the participants in both the EMS and the ED, highlights areas of improvement in specific elements within the ePMR. The OOH-GPs expresses a general contentment of MedWin as EMR. MedWin provides short and specific information of the patient. However, the OOH-GPs identifies demand for greater access to additional patient information, especially when performing home-based consultations, since the patient information is solely available on the laptop connected within the taxi.

Throughout interviews and observations, the participants described potential data sharing across healthcare settings and we have identified that a shared system must present solely relevant patient information. We conclude that the potential shared system must be a boundary object: plastic enough to local use, yet robust enough to maintain common identity. Furthermore, that the participants desire aggregated, structured, and standardized data in order to achieve a shared system with only relevant data - thereby avoiding information-overload. We suspect that applying artificial intelligence as a way of handling the large amount of data provided by the healthcare services can streamline the data automatically in relation to the user's needs. The included prominent individuals from Digitalization and IT and Danish Health Data Authority, are supporting the idea of a shared system and states that it is technically possible. However, points out that the process of developing the system is difficult.

We conclude that a shared system is not inconceivable. However, the process of shaping and developing such system can be difficult. Moreover, we believe that even though the participants could

access more patient data within the shared EMR system, the three groups of actors i.e. EMS clinicians, ED clinicians, and OOH-GPs will still prioritize and have the patient in focus. The utilization of the shared system will be dependent of the context as a reflection of the participants all working within the field of emergency medicine.

We have performed observations in EMS and ED settings, which form the foundation for future studies of performing participatory observations in OOH-GP. Another direction which could be feasible, is researching whether artificial intelligence is able to handle data and streamline data to user needs, as we suspect. Furthermore, we would love to study whether interdisciplinary processes could be achieved - *towards shaping a united system*.

10. List of references

A

Adam, R., Bruin, M., Burton, C. D., Bond, C. M., Clausen, M. G. and Murchie P. (2017) 'What are the current challenges of managing cancer pain and could digital technologies help?', *BMJ Supportive and Palliative Care*. 8, p204-212.

Ah-Kye L. and Moore M. (2015) 'A simple prioritisation system to improve the electronic handover', *BMJ Quality Improvement Reports*, 4(1).

Andersson, U., Söderholm, H. M, Sundström, B. W., Hagiwara, M. A. and Andersson, H. (2019) 'Clinical reasoning in the emergency medical services: an integrative review', *Scand J Trauma Resusc Emerg Med*.

Azarm-Diagle, M., Kuziemsky, C. and Peyton, L. (2015) 'The 5th International Conference on Current and Future Trends of Information and Communication Technologies in Healthcare (ICTH 2015) - A Review of Cross Organizational Healthcare Data Sharing', *Procedia Computer Science*, 63(2015) p. 425-432.

B

Balla, J., Heneghan, C., Thompson, M. and Balla, M. (2012) 'Clinical decision making in a high-risk primary care environment: a qualitative study in the UK', *BMJ Open,* 2(2).

Bossen, C. Jensen, L. G. and Udsen F. W. (2013) 'Boundary-Object Trimming: On the Invisibility of Medical Secretaries' Care of Records in Healthcare Infrastructures', *Computer Supported Cooperative Work*, 23(1), p75-110.

Bryant and Charmaz (2007) *The SAGE Handbook of Grounded Theory*. London: SAGE Publications Ltd.

C

Christensen, E. F. (2017). Prehospital effort. In: A. Jakobsen; C. Skjærbæk, and N. K. Villumsen. *Acute Book - for doctors and nurses*. Copenhagen: Munksgaard Copenhagen. (401-407)

Christensen, T and Grimsmo, A. (2008) 'Expectations for the next generation of electronic patient records in primary care: A triangulated study', *Informatics in primary care*. (16), p21-8.

Clarke, A. E. and Friese, C. (2007) 'Grounded Theorizing Using Situational Analysis' in Bryant A. and Charmaz K. (ed) *The SAGE Handbook of Grounded Theory.* London: SAGE publications, pp. 361-397.

D

Danish Health Data Authority (2019) Current status and overview of FMK [Online]. Available at: https://sundhedsdatastyrelsen.dk/da/registre-og-services/om-faelles-medicinkort/status-og-overblik-fmk (Accessed 3rd of June, 2020).

Danish Regions (2015) 'The role of healthcare data'.

Danish Regions (2018) 'The Regions EMR-systems support patient care progress.'

E

Ebben, R. H. A., Grunsven, P. M., Moors, M. L., Aldenhoven, P., Vaan, J., Hout, R., Actherberg, T. and Vloet, L. C. M. (2015) 'A tailored e-learning program to improve handover in the chain of emergency care: a pre-test post-test study', *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine,* 23(33).

F

Fitzpatrick, D., McKenna, M., Duncan, E. A. S., Laird, C., Lyon, R. and Corfield, A. (2018) 'Critcomms: a national cross-sectional questionnaire based study to investigate prehospital handover practices between ambulance clinicians and specialist prehospital teams in Scotland', *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine,* 26(45).

G

Glaser, B. G. and Strauss, A. L. (1967) *The Discovery of Grounded Theory: Strategies for Qualitative Research*. 1st edn. New Brunswick and London: Aldine Transaction - a Division of Transaction Publishers.

Grol, R., Giesen, P., and van Uden, C. (2006) 'After-hours care in the United Kingdom, Denmark, and the Netherlands: new models', *Health affairs (Project Hope)*, (*25*(6)), p1733–1737.

H

Hall., C. C., Lunan, C., Finucane, A. and Spiller J. A. (2017) 'Improving access to the KIS in secondary care', *BMJ Open Quality,* 6(2).

Harmsen, A. M. K., Geeraedts, L. M. G., Giannakopoulos G. F., Terra, M., Christiaans, H. M. T., Mokkink, L. B. and Bloemers, F. W. (2017) 'National consensus on communication in prehospital trauma care, the DENIM study', *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine,* 25(67).

Haraway, D. (1988) 'Situated knowledges: the science question in feminism and the privilege of partial perspective', *Feminist Studies*, 14(3), p575-599.

Healthcare Record (2020) *Your Health Care Portal* [Online]. Available at: https://www.sundhed.dk/sundhedsfaglig/ (Accessed 3rd of June, 2020).

Hjortdahl, M., Zakariassen, E., and Halvorsen, A. P. (2018) 'Self reported involvement in emergency medicine among GPs in Norway', *Scandinavian Journal of Primary Health Care*. 36(2), p161-169.

Hovenkamp, G. T., Olgers, T. J., Wortel, R. R., Noltes, M. E., Dercksen, B. and Cornelis ter Maaten, J. (2018) 'The satisfaction regarding handovers between ambulance and emergency department nurses: an observational study', *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine,* 26(78).

Huibers, L., Moth, G., Andersen, M., van Grunsven, P., Giesen, P., Christensen, M. B., and Olesen, F. (2014) 'Consumption in out-of-hours health care: Danes double Dutch?', *Scandinavian journal of primary health care*, 32 (1), p44–50.

Højgaard B. and Kjellberg, J. (2017) 'Five mega-trends that challenges the future health care sector', *KORA - the national institute for municipalities and regions analysis and research.*

J

Jest, P. and Tynan, L. (2010) 'The electronic medical record - a technological and organizational travel' in Nøhr, C., Vingtoft, S., Bertelsen, P. and Andersen S. K (ed(s)). *Digitization of the Danish Health Care Sector: Eyewitness reports from key actors.* 1st edn. Denmark: Syddansk Universitetsforlag, 75-89.

K

Kensing, F. and Greenbaum, J. (2013) 'Heritage: having a say' in Simonsen, J. and Robertsen, T. (ed) *Routledge International Handbook of Participatory Design.* New York: Taylor and Francis Ltd.

Knutsen, G. O. and Fredriksen, K. (2013) 'Usage of documented pre-hospital observations in secondary care: a questionnaire study and retrospective comparison of records', *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 21(13).

Krogh-Jensen, P. (1984) 'Electronic Records for General Practice the Danish System', *Scandinavian Journal of Primary Health Care* (2:3), p121-123.

L

Lindskou, T. A., Mikkelsen, S., Christensen E. F., Hansen, P. A., Jørgensen, G., Hendriksen, O. M., Kirkegaard, H., Berlac, P. A. and Søvsø, M. B. (2019) 'The Danish prehospital emergency healthcare system and research possibilities', *Scandinavian J Trauma Resusc Emerg Med* (27/100).

M

Mackenhauer, J. (2017) 'The emergency patient population'. In: Jakobsen, A., Skjærbæk, C., & Villumsen, N. K. *Acute Book - for doctors and nurses*. Copenhagen: Munksgaard Copenhagen. (23-27).

Meaker R. (2018) 'Information flow to enable integrated health care: integration or interoperability', *British Journal of General Practice*, 68(670), p110-111.

Miller, C. H. (2001) *UTOPIA*. 2nd edn. London: Yale University Press.

Ministry of Health (2018) '*Announcement of authorized healthcare professionals patient records'*. BEK nr 530 af 24/05/2018.

N

Neyland, D. (2008) *Organizational Ethnography.* 1st edn. London: SAGE Publications Ltd.

Niebuhr, U (2015). The patient medical record in the North Denmark Region [Online]. Available at: https://pri.rn.dk/Sider/8289.aspx (Accessed 3rd of June, 2020).

Norri-Sederholm, T., Paakkonen, H., Kurola, J. and Saranto, K. (2015) 'Situational awareness and information flow in prehospital emergency medical care from the perspective of paramedic field supervisors: A scenario-based study', *Scandinavian journal of trauma, resuscitation and emergency medicine* 23(4).

Nøhr, C., Vingtoft, S., Bertelsen, P. and Andersen S. K. (2019). *Digitization of the Danish Health Care Sector: Eyewitness reports from key actors.* 1st edn. Denmark: Syddansk Universitetsforlag.

O

OECD (2020) Ageing and demographic change [Online]. Available at: https://www.oecd.org/economy/ageing-inclusive-growth/ (Accessed 3rd of June, 2020).

O'Reilly, K. (2019) 'Team Ethnography' in O'Reilly K. (ed.) *Key Concepts in Ethnography.* London: SAGE publications Ltd, pp. 202-208.

Owen, C., Hemmings, L. and Brown T. (2009) 'Lost in translation: Maximizing handover effectiveness between paramedics and receiving staff in the emergency department', *Emergency Medicine Australia* 21(2), p102-107.

P

Patel, R. and Thiagarajan, P. (2014) 'Structured approach in improving weekend handovers in a medical high dependency unit', *BMJ Quality Improvement Reports*, 3(1).

PLO and the North Denmark Region (2020). *Agreement on operation and organization of the out-of-hours general practitioner in the North Denmark Region*.

Poulsen, N. R., Kløjgaard, T. A., Lübcke, K., Lindskou, T. A., Breinholt Søvsø, M., and Christensen, E. F. (2020) 'Completeness in the recording of vital signs in ambulances increases over time', *Danish Medical Journal*. *67*(2), p1-6.

R

Raarber, N., Duvald, I., Riddervold, I., Christensen E. F. and Kirkegaard, H. (2016) 'Geographic information system data from ambulances applied in the emergency department: effects on patient reception', *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 24(39).

Rigsrevisionen (2020). Electronic Medical Records in-hospital.

S

Shelton, D. and Sinclair, P. (2016) ‘Availability of ambulance patient care reports in the emergency department’, *BMJ Quality Improvement Reports*, 5.

Skelton, L., Rogers, J. and Kalafatis, C. (2019) ‘Development and implementation of electronic medical handovers across psychiatric hospitals: quality improvement initiative’, *BMJ Quality Improvement Report*, 8(4).

Spradley, J. (1980) *Participant Observation*. 1st edn. New York: Harcourt Brace College Publishers.

Staff, T. and Søvik, S. (2011) ‘A retrospective quality assessment of pre-hospital emergency medical documentation in motor vehicle accidents in south-eastern Norway’, *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine,* 19(20).

Star, S. L. and Griesemer, J. R. (1989) ‘Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39’, *Social Studies of Science*, 19(3), p387-420.

Statistics Denmark (2018) *significantly more elderly in the future* [Online]. Available at: https://www.dst.dk/da/Statistik/nyt/NytHtml?cid=26827 (Accessed 3rd of June, 2020).

Sujan, M. A., Chessum, P., Rudd, M., Fitton, L., Inada-Kim, M., Spurgeon, P. and Cooke M. W. (2013) ‘Emergency Care Handover (ECHO study) across care boundaries: the need for joint decision making and consideration of psychosocial history’, *BMJ Emergency Medicine Journal*, 32(2), p112-118.

Søvsø, M. B., Christensen, M. B., Bech, B. H., Christensen, E. F. and Huibers, L. (2019) ‘Contacting out-of-hours primary care or emergency medical services for time-critical conditions - impact on patient outcomes’, *BMC Health Services Research.*

Søvsø, M. B., Huibers, L, Bech, B.H. , Christensen, H.C., Christensen, M.B. and Christensen, E.F. (2020) 'Acute care pathways for patients calling the out-of-hours services', *BMC Health Services Research.*

T

Tanggaard, L. and Brinkmann, S. (2015) 'The interview: The conversation as research method' in Brinkmann, S. and Tanggaard, L. (ed.) *Qualitative methods: A textbook*. 2nd edn. Copenhagen: Hans Reitzels Publishers. pp.29-54.

The North Denmark Region (2019) Prehospital Medical Record [Online]. Available at: https://rn.dk/da/Sundhed/Til-sundhedsfaglige-og-samarbejdspartnere/National-og-Tvaersektoriel-IT/PPJ (Accessed 3rd of June, 2020).

W

Warfvinge, J. (2007). EMR in Denmark before formation of Regions in 2007.*V-CHI 12-2.*

Z

Zhang, Z., Ahmed, F., Zhau, R., Mueller, K., Wang, B., Ramakrishnan, I., and Viccellio, A. W. (2013) 'The Five Ws for Information Visualization with Application to Healthcare Informatics', *IEEE transactions on visualization and computer graphics.*