

## **Understanding Reaction to Early Signs of Development of Myocardial Infarction and Out-of-Hospital Heart Arrest**

*A Qualitative Study of the Communicative Interaction Between Patients and Call-Takers in Telephone Consultations Preceding Myocardial Infarction and Out-of-Hospital Cardiac Arrest*  
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# **UNDERSTANDING REACTION TO EARLY SIGNS OF DEVELOPMENT OF MYOCARDIAL INFARCTION AND OUT-OF- HOSPITAL HEART ARREST**

A QUALITATIVE STUDY OF THE COMMUNICATIVE  
INTERACTION BETWEEN PATIENTS AND CALL-TAKERS  
IN TELEPHONE CONSULTATIONS PRECEDING MYOCARDIAL  
INFARCTION AND OUT-OF-HOSPITAL CARDIAC ARREST

**BY  
BRITTA JENSEN**

DISSERTATION SUBMITTED 2023



**AALBORG UNIVERSITY**  
DENMARK



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## CV

Britta Jensen holds a bachelor's degree in Nutrition and Health from VIA University College in Aarhus from 2008 and a master's degree in Public Health from Aalborg University in 2019. During her master's education, Britta specialized in the field of Public Health and has gained experience with qualitative methods.

Since 2019, Britta has been enrolled as a PhD fellow at the Public Health and Epidemiology Group at the Department of Health Science and Technology at Aalborg University. During her PhD fellowship, Britta has been part of the Early Warning Research group, a collaboration of researchers from Aalborg University, Aalborg University Hospital, Hillerød, and Gentofte hospital. Her PhD project is co-funded by The Danish Heart Foundation and centers on the communicative interaction in medical emergency services telephone consultations preceding myocardial infarction and out-of-hospital cardiac arrest. During her PhD fellowship, Britta spent six months full-time teaching and supervising students studying for the bachelor's degree in Medicine and master's degree in Public Health.

As part of the PhD project, Britta was a Visiting Research Scholar at the Austrian Public Health Organization in Vienna between July 2021 and August 2021. During her stay, Britta was under the supervision of Dr. Peter Nowak who is co-leader of the WHO Collaborating Centre Health Promoting Hospitals and Health. Dr. Peter Nowak is involved in research on health literacy and communication in the healthcare sector. The work conducted during the stay will continue in future research projects after the PhD.

UNDERSTANDING REACTION TO EARLY SIGNS OF DEVELOPMENT OF MYOCARDIAL INFARCTION AND OUT-OF-HOSPITAL HEART ARREST



# ENGLISH SUMMARY

## *Background*

A range of symptoms associated with myocardial infarction or out-of-hospital cardiac arrest has been identified, yet several symptoms are characterized as nonspecific challenging the identification of an evolving myocardial infarction or out-of-hospital cardiac arrest. Telephone consultation constitutes a complex setting where the decision-making process on choice of response is affected by the communicative interaction between patient and call-taker because a thorough physical examination is not possible. To understand how the communicative interaction between patient and call-taker might affect the interpretation of the severity of the patient's experienced condition, hence, the decision-making process on choice of response, in-depth knowledge is needed to understand reaction to early signs of development of myocardial infarction and out-of-hospital cardiac arrest.

## *Objective*

The overall objective of this PhD study is to gain knowledge on how patients observe, describe, understand, and interpret early warning signs of myocardial infarction and out-of-hospital cardiac arrest expressed in telephone consultations preceding suffering a MI and OHCA. In addition to this, to gain knowledge on how call-takers react to the patients' experienced condition through observation of the decision-making process on choice of response.

Three research aims form the basis for the overall objective and are addressed in three separate papers:

- Paper 1 aims to explore characteristics in patients' interpretation of experienced conditions where an evolving MI was not initially recognized, and how the patients described the conditions in the telephone consultations.
- Paper 2 aims to explore what characterized the development in the call-taker's decision-making process as it was expressed in the communicative interaction with patients where an evolving MI was not recognized at first.
- Paper 3 aims to explore how communication between patient and call-taker influenced the call-taker's interpretation of the patient's back pain descriptions and implementation of treatment in telephone consultations within 24 hours before the patient suffered an OHCA.

## *Methodology*

Informed by constructivism and social systems theory, as outlined by Niklas Luhmann, the PhD study was designed as a qualitative study. Data were collected among patients who had been in contact with the Copenhagen emergency medical services from 2016 to 2018 and had suffered a myocardial infarction or an out-of-

hospital cardiac arrest. Through stratified purposive sampling strategy, 14 females and 23 males were included, and 60 calls made by the patients were analysed. Paper 1 is based on the penultimate call among 21 patients subsequently diagnosed with a myocardial infarction, paper 2 is based on the penultimate call and the last call among 19 patients subsequently diagnosed with a myocardial infarction. Paper 3 draws on 20 calls up to 24 hours before suffering an out-of-hospital among 17 patients. The interpretation of data was performed using social systems theory, as outlined by Niklas Luhmann, and qualitative content analysis by Margrit Schreier was performed.

### *Findings*

The findings of the study showed that patients faced challenges when describing and interpreting the severity of the experienced condition. Due to unclear symptoms or complex conditions, it seemed to be difficult for the patients to determine whether the 1813-medical helpline or the emergency number 1-1-2 was to be contacted, which potentially affected the call-takers' interpretation of the severity of the patients' experienced conditions. Patients often described conditions not corresponding to the health professional understanding of severe conditions or described the experienced condition in a way that caused the call-taker to not recognize an evolving myocardial infarction or an approaching out-of-hospital cardiac arrest. Furthermore, patients seemed to actively try to interpret the experienced condition leading to worry and insecurity because of unclear symptoms.

From the call-taker's perspective, negotiation of response, assurance against misinterpretation, postponement of the evaluation of the severity, and recommended follow-up were approaches applied in the decision-making process on choice of response in case of unclear symptoms or complex conditions.

### *Implications for practice*

To facilitate faster recognition of severe conditions warranting hospital referral, the professional call-taker must consider the patient's description of the experienced condition might differ from the health professional understanding of a severe condition. Decision support tools in the present form may not always assist the call-taker's recognition of an evolving myocardial infarction and out-of-hospital cardiac arrest. Hence, there seems to be a potential for learning by facilitating reflection on potential revisions of the decision support tools. Moreover, the call-taker needs to be attentive to unclear and complex symptoms presentations, as they pose a particular challenge for the patient to describe, understand and interpret, hence, for the call-taker to understand and interpret. Moreover, the call-taker must be able to set aside the patient's interpretation and explore the severity of the condition independently of the patient's assessment, especially when the patient applies technical terms, as the patient's understanding of technical terms may not correspond to the professional understanding. Furthermore, the call-taker must contemplate that the patient might contact the 1813-medical helpline because the experienced condition could be difficult to interpret, thus, needing assistance from a health professional, and not necessarily because the condition is not severe.

### *Conclusion*

Findings show that patient's descriptions of unclear symptoms and complex conditions make it difficult to interpret the severity of the experienced condition, both from the patient's perspective and the call-taker's perspective. As a result, patients might become worried and insecure. Conditions not resulting in offer of hospital referral are characterized by complex symptom descriptions that do not seem to match the health system's interpretation of a severe condition. Decision support tools seem efficient when handling well-defined problems with well-established solutions but are limited in cases with unclear symptoms or complex conditions leading to an interactive communicative diagnostic negotiation. Patients may call the non-emergency 1813-medical helpline because they need assistance in interpreting the severity, not because the experienced condition is not severe.

# DANSK RESUME

## *Baggrund*

En række symptomer forbundet med udviklingen af myokardieinfarkt eller hjertestop udenfor hospital er blevet identificeret. Flere af symptomerne er kendetegnet ved at være uspecifikke og vanskeliggør derfor erkendelse af et forestående myokardieinfarkt eller hjertestop udenfor hospital. Telefonkonsultationer udgør en kompleks situation, hvor den kommunikative interaktion mellem patient og sundhedsfaglige visitator påvirker beslutningsprocessen om valg af respons, idet grundig fysisk undersøgelse af patienten ikke er mulig. For at opnå forståelse for, hvordan den kommunikative interaktion mellem patient og sundhedsfaglig visitator kan påvirke fortolkningen af alvorlighedsgraden i patientens tilstand og derigennem beslutningsprocessen om valg af respons, er dybdegående viden nødvendig for at forstå reaktion på tidlige tegn på udvikling af myokardieinfarkt og hjertestop udenfor hospital.

## *Formål*

Det overordnede formål med dette Ph.d.-studie er at opnå forståelse for hvordan patienten, observerer, beskriver, forstår og fortolker tidlige tegn på myokardieinfarkt og hjertestop udenfor hospital og hvordan de kommer til udtryk i telefonkonsultationer forud for tilfælde af myokardieinfarkt og hjertestop udenfor hospital. Derudover at opnå viden om, hvordan sundhedsfaglige visitatorer reagerer på patienters oplevede tilstand gennem observation af beslutningstagningsprocessen om valg af respons.

Det overordnede formål adresseres i tre specifikke artikler med hver sit formål:

- Formålet med første artikel er at undersøge karakteristika i patienters fortolkning af deres oplevede tilstand, hvor et myokardieinfarkt under udvikling ikke blev erkendt i første omgang, og hvordan patienten beskrev sine symptomer i telefonkonsultationerne.
- Formålet med anden artikel er at undersøge hvad der karakteriserer udviklingen i den sundhedsfaglige visitators beslutningstagningsproces udtrykt i den kommunikative interaktion med patienter hvor et myokardieinfarkt under udvikling ikke blev erkendt i første omgang.
- Formålet med tredje artikel er at undersøge hvordan kommunikationen mellem patient og sundhedsfaglig visitator påvirkede den sundhedsfaglige visitators fortolkning af patientens rygsmertebeskrivelser og implementering af behandling i telefonkonsultationer op til 24 før patienten led af et hjertestop udenfor hospital.

## *Metodologi*

Med ståsted i konstruktivisme samt system teori, som beskrevet af Niklas Luhmann, er afhandlingen designet som et kvalitativt studie. Data blev udvalgt blandt patienter,

som havde været i kontakt med Akutberedskabet i København i perioden fra 2016 til 2018 og havde lidt af et myokardieinfarkt eller et hjertestop udenfor hospital. På baggrund af stratificeret formålsrettet tilgang til samling blev 14 kvinder og 23 mænd udvalgt, og i alt 60 af de udvalgte patienters opkald blev analyseret. Artikel 1 er baseret på næstsidste opkald blandt 21 patienter som efterfølgende diagnosticeres med et myokardieinfarkt, artikel 2 er baseret på næstsidste og sidste opkald blandt 19 patienter, som efterfølgende diagnosticeres med et myokardieinfarkt. Artikel 3 inddrager 20 opkald blandt 17 patienter, der op til 24 før patienten led af et hjertestop udenfor hospital havde været i kontakt med Akutberedskabet i København. Analysen og fortolkning af data blev udført med anvendelse af kvalitativ indholdsanalyse, som beskrevet af Margrit Schreier.

### *Resultater*

Resultaterne viste, at patienterne blev konfronteret med udfordringer, når de beskrev og fortolkede alvorlighedsgraden af de oplevede tilstande. Uklare symptomer og komplekse tilstande medførte, at det var vanskeligt for patienterne at vurdere om de skulle kontakte akuttelefonen 1813 eller alarm 1-1-2, hvilket potentielt påvirkede den sundhedsfaglige visitors fortolkning af alvorlighedsgraden af patienternes oplevede tilstande. Patienterne beskrev ofte tilstande, der ikke var i overensstemmelse med den sundhedsfaglige forståelse af alvorlige tilstande eller beskrev tilstanden på en måde, der medførte, at den sundhedsfaglige visitor ikke erkendte et myokardieinfarkt eller hjertestop udenfor hospital under udvikling. Patienterne forsøgt aktivt at fortolke deres oplevede tilstande, men uklare symptomer medførte, at patienterne blev bekymrede og usikre.

Fra det sundhedsfaglige perspektiv blev tilgangene forhandling af respons, forsikring mod fejlfortolkning, udskydelse af evaluering af alvorlighedsgraden og anbefalet opfølgning anvendt i beslutningstagningsprocessen om valg af respons i tilfælde af uklare symptomer eller komplekse tilstande.

### *Implikationer til praksis*

For at facilitere hurtigere erkendelse af alvorlige tilstande, som kræver hospitalsindlæggelse, må den sundhedsfaglige visitor være bevidst om, at patientens beskrivelse af den oplevede tilstand kan adskille sig fra den sundhedsprofessionelle opfattelse af alvorlige tilstande. Beslutningsstøtteværktøjer i sin nuværende form formår ikke nødvendigvis at assistere den sundhedsfaglige visitors erkendelse af et myokardieinfarkt eller hjertestop udenfor hospital under udvikling. Det indikerer et potentiale for læring ved at facilitere refleksion for potentielle revisioner af beslutningsstøtteværktøjerne. Den sundhedsfaglige visitor kan med fordel have ekstra fokus på uklare og komplekse tilstande, da de er særligt udfordrende at beskrive, forstå og fortolke for patienten, og dermed også udfordrende at forstå og fortolke for den sundhedsfaglige visitor. Endvidere indikerer studiet, at den sundhedsfaglige visitor bør tilsidesætte patientens egen fortolkning af tilstanden og undersøge tilstandens alvorlighedsgrad uafhængigt af patientens vurdering, særligt når patienten anvender lægefaglige udtryk, da patientens forståelse af lægefaglige udtryk ikke nødvendigvis stemmer overens med den sundhedsprofessionelle forståelse. Den sundhedsfaglige visitor bør derudover være opmærksom på, at

patienten kan vælge at ringe til akuttelefonen 1813, fordi de har brug for hjælp til at fortolke alvorlighedsgraden og ikke nødvendigvis fordi tilstanden er harmløs.

### *Konklusion*

Uklare symptomer og komplekse tilstande vanskeliggør både patientens og den sundhedsfaglige visitors fortolkning af alvorlighedsgraden af patientens oplevede tilstand. Det resulterer i, at patienten kan blive bekymret og usikker. Komplekse symptombeskrivelser, der ikke stemmer overens med sundhedssystemets fortolkning af alvorlige tilstande, kendetegner de tilstande, der ikke resulterer i tilbud om hospitalsindlæggelse. Beslutningsstøtteværktøjer er effektive, når det drejer sig om veldefinerede problemer med veletablerede behandlingsanvisninger, men effekten kan være begrænset i tilfælde med uklare symptomer eller komplekse tilstande. Sidstnævnte resulterer i en interaktiv kommunikativ diagnostisk forhandling. Patienter ringer ikke udelukkende til akuttelefonen 1813, fordi den oplevede tilstand er harmløs. Opkald foretages også til akuttelefonen 1813, fordi patienter har brug for hjælp til at fortolke alvorlighedsgraden af oplevede tilstand.







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# CHAPTER 1. INTRODUCTION

## 1.1 MYOCARDIAL INFARCTION AND OUT-OF-HOSPITAL CARDIAC ARREST

Cardiovascular disease (CVD) is an umbrella term for medical conditions concerning the heart's circulation, valves, myocardium, and rhythm. Pericardial structures and the arterial or venous vascular systems may be affected (Wing & Schiffman, 2021). Coronary heart disease (CHD), a sub-group of CVD, is a collective name of diseases caused by arteriosclerosis in the coronary arteries (Wing & Schiffman, 2021), and despite advancements in the field, it remains a leading cause of morbidity and mortality globally (Waller et al., 2022; WHO, 2018; Wing & Schiffman, 2021), hence, constitutes as a common public health problem. In the United States, CHD accounts for almost one in three deaths and is the leading cause of death among both females and males (Wing & Schiffman, 2021). Acute coronary syndromes (ACS) refer to three types of CHD: unstable angina, myocardial infarction (MI,) and sudden cardiac death. MI commonly stems from the complete clogging of the coronary artery by disrupted atheromatous plaque. Sudden cardiac arrest is typically associated with MI, and the condition occurs when fatal ventricular arrhythmias emerge caused by ischaemic tissue or ventricular rupture (Waller et al., 2022). Out-of-hospital cardiac arrest (OHCA) refers to the cessation of cardiac mechanical activity with no signs of circulation and occurs outside of hospital. Up to 70%-85% of OHCA events occur from a cardiac cause (McNally et al., 2011).

Early recognition of symptoms related to the development of MI and OHCA has been found to encourage help-seeking behavior and thereby increases not only the chances of successful therapy but also the range of treatments (Alfsen et al., 2015; Berdowski et al., 2009; Gnesin et al., 2021; Kirchberger et al., 2012). A range of symptoms associated with MI or OHCA has been identified (Blakeman & Booker, 2016; Løvlien et al., 2009; A. L. Møller et al., 2021; Nishiyama et al., 2013; O'Keefe-McCarthy & Ready, 2016; Ottesen et al., 2003; Wing & Schiffman, 2021), still, several symptoms are characterized as nonspecific challenging the identification of an evolving MI or OHCA (Løvlien et al., 2009; O'Keefe-McCarthy et al., 2016; Waller et al., 2022). Among patients suffering a MI, atypical symptom presentation (without chest pain) might be more prevalent than previously assumed (Brieger et al., 2004; Li & Yu, 2017; A. L. Møller et al., 2020). In addition, recognition of an evolving MI is complicated by patients' various symptoms experiences and descriptions not corresponding to the medical literature (Lindström et al., 2014; T. P. Møller et al., 2017; Palsgaard Møller et al., 2021). Symptoms regarding MI and OHCA can be classified according to symptom onset. Symptoms prior to MI or OHCA are classified as early warning signs or prodromal symptoms and symptoms during MI or OHCA are classified as acute symptoms (J. C. McSweeney et al., 2003; Nishiyama et al., 2013). Prodromal symptoms are defined as new symptoms or symptoms changing in intensity or frequency before the MI or OHCA and returning to previous levels before the MI or OHCA or disappearing after treatment (J. C. McSweeney et al., 2003). The

prodromal symptoms occur in the weeks or months prior to MI (Løvlien et al., 2009; J. C. McSweeney et al., 2003). The timeframe of prodromal symptoms concerning OHCA is minutes and hours (Nishiyama et al., 2013). Patients and health professionals may misinterpret prodromal symptoms and attribute them to non-cardiac causes, leading to delayed diagnosis and poorer treatment outcomes, ultimately death (Lichtman et al., 2018; Ottesen et al., 2003)

To identify patients with cardiovascular disease, a combination of an understanding of the pathophysiology of heart disease together with knowledge of the patient's history and thorough physical examination is needed including for example blood test and electrocardiogram (ECG) (Wing & Schiffman, 2021).

## 1.2 THE DIAGNOSTIC PROCESS

The probability of a patient having a specific disease must be sufficiently large before a diagnosis can be made. To diagnose a patient the first step is pattern recognition based on a probabilistic approach to be able to dismiss differential diagnoses. The pathological picture in the form of symptom descriptions is a decisive factor in pattern recognition and through this determines whether a patient can be diagnosed with a specific disease. The subjective probability describes the health professional's confidence in the patient having the suspected disease (Wulff & Göttsche, 2001).

Several factors affect the subjective probability including patient history, family history of specific diseases, and a thorough physical examination (Wing & Schiffman, 2021; Wulff & Göttsche, 2001). Next, the health professional applies a deductive approach, where knowledge of different diseases is considered based on the registered symptoms. A recommended approach is to start with one symptom. On the one hand, the health professional must consider the consequences of possible diagnoses by contemplating the possibility of rare but severe or potentially fatal diseases. On the other hand, overdiagnosis is undesirable as is initiating treatment based on uncertain diagnosis. Furthermore, there is a probability that the diagnosis may change in the diagnostic process as information is gathered (Wulff & Göttsche, 2001). Hence, the diagnostic process is a balancing act between different considerations including an element of prediction of the development of the condition. From a health professional perspective, symptoms and diagnoses become the understanding in which the patient's condition is interpreted. The patient, however, might not communicate according to this understanding and to describe the experienced condition, the patient might use technical words and descriptions they may not fully understand or apply correctly. Thus, communicative interaction has a pivotal role in the interpretation of a condition and the diagnostic process.

A special focus issue in the clinical assessment of possible cardiovascular disease is the uncertainty surrounding the cardinal symptoms of cardiovascular disease. Even though chest pain is one of the cardinal symptoms, it may also be the cause of non-cardiovascular diseases (Wing & Schiffman, 2021). Furthermore, up to 15 % of patients diagnosed with MI do not report pain (Waller et al., 2022). A clinical setting



with face-to-face interaction between health professionals and patients offers the optimal starting point for an examination of the condition as the health professional has direct access to the patient to make a thorough physical examination as a supplement to the patient's descriptions of symptoms (Wing & Schiffman, 2021).

### 1.3 ORGANISATION OF THE HEALTHCARE SYSTEM

In Denmark, the healthcare system is an important part of the Danish welfare society and is charged with offering fast, safe, and efficient treatment to all citizens (Indenrigs- og Sundhedsministeriet, 2019). The task is distributed between 97 municipalities, five administrative regions, and general practitioners. The general practitioner acts as a gatekeeper to the services of the healthcare system by attending to the patient's medical problems and referring patients to specialized treatment if needed (Sundhedsministeriet, n.d.-b). The Danish healthcare system is divided into different sectors, one of which is the prehospital setting, including the emergency medical services (EMS) consisting of the emergency number 1-1-2 and the out-of-hours healthcare service (Vinge & Rasmussen, 2018). In the period this study is conducted, out-of-hours care was handled by the five administrative regions, which used two different triage models: four regions used a general practitioner cooperative and the Capital Region used the 1813-medical helpline (Vinge og Susanne Reindahl Rasmussen, 2018). In case of an emergency or acute illness, the EMS makes it possible to dispatch ambulances. The prehospital setting manages the combined healthcare services until hospital admission (Sundhedsministeriet, n.d.-a). To gain access to the emergency department at the hospital, the patient must contact their general practitioner or the EMS (sundhed.dk, n.d.). Therefore, the EMS function as one of the gatekeepers to the services of the healthcare system as it is the call-taker's decision-making on choice of response that determines whether a patient gains access to hospital referral. A detailed description of the study setting is presented in section 2.3 *Study setting*.

Other European countries have a similar organisation of the prehospital setting to accommodate a growing workload in hospital emergency departments and increasing demand for after-hours care (Anderson & Roland 2015, Leibowitz et al 2003, Smits, Rutten et al, 2017). For example, Swedish Healthcare Direct is a telephone nursing service, which is open 24 hours a day all year and is often the first contact with the healthcare system. The triage is supported by a digital decision support tool (Kaminsky et al., 2017). In UK, the National Health Service has developed the telephone triage system NHS Pathways consisting of a single clinical assessment tool. NHS Pathways is used in emergency calls (999) and non-emergency calls (NHS 111) as well as out-of-hours calls to the general practitioner (Anderson & Roland, 2015; Deakin et al., 2017). The nationally uniform primary care physician (PCP) cooperatives provide after-hours primary care in the Netherlands. As part of the PCP cooperatives nurses provide telephone triage supported by the digital decision support tool the Netherlands Triage Standard. In addition, a primary care physician supervises the nurses and can be consulted if needed (Smits, Rutten, et al., 2017).

In telephone triage, the success of greater treatment outcome depends in part of patients' ability to identify prodromal symptoms and react accordingly, but also on health professionals' ability to interpret the patients' symptom description accurately. Subsequent communication between patient and health professional, which considers the complexity of prodromal symptom presentation associated with MI or OHCA, is pivotal for accurate interpretation and implementation of efficient treatment.

## 1.4 THE SETTING OF TELEPHONE CONSULTATION

To accommodate the growing workload and to offer care out-of-hours, telephone triage plays an increasing role in Western countries (Anderson & Roland, 2015; Langhelle et al., 2004; Montandon et al., 2019; Smits, Rutten, et al., 2017). Telephone consultation constitutes a complex setting where the decision-making process on choice of response is affected by the communicative interaction between patient and call-taker because a thorough physical examination is not possible. Although call-takers in telephone consultations play a crucial role in recognizing conditions warranting hospital referral (Castrén et al., 2008; Richards et al., 2022), the risk of misinterpreting the severity of the condition is present (Yliluoma & Palonen, 2020), particularly in cases with descriptions of symptoms not recognized in the medical literature or incompetent communication (Gamst-Jensen et al., 2017). Following this, the patient's ability to describe the condition and the call-taker's capability to make a sound assessment of the severity is found to influence the decision-making process (Gamst-Jensen et al., 2017; I. Holmström & Höglund, 2007).

From the call-taker's perspective, several aspects might complicate the assessment of the severity in telephone consultations. A study exploring tele nurses' experiences of the communicative interaction with patients found that the nurses' communication skills played a vital role in enabling the interaction. This was seen both in relation to taking control over the communication by asking questions that focused the interaction on vital information and giving the caller the time to explain the condition (Yliluoma & Palonen, 2020). Likewise, lack of structure in the communicative interaction was found to affect the assessment of severity negatively (Lindström et al., 2014).

Not being able to see the patients challenges the decision on choice of response as the only source of information is verbal utterances from the patient (Ek & Svedlund, 2015; I. Holmström & Höglund, 2007; Pettinari & Jessopp, 2001). One approach to compensate for lack of face-to-face interaction is to pay attention to non-verbal utterances by the patient (Wouters et al., 2020). Another approach is to ask specific questions about the location of the symptoms or request the patient to self-test e.g. the range of motion or measure blood pressure (Pettinari & Jessopp, 2001; Yliluoma & Palonen, 2020). Prior clinical experience seems to facilitate navigating the interpretation of the patient's condition without being able to see the patient to a greater extent than no prior clinical experience (Yliluoma & Palonen, 2020). Unclear symptom descriptions without a well-defined primary problem and contradictory information are found to make it difficult to assess the condition, thus, complicating

the decision on choice of response (Gamst-Jensen et al., 2017; Lindström et al., 2014). In addition, the assessment of the severity is at risk of being inhibited when the call-taker focuses on the patient's interpretation of the primary problem instead of assessing other information from the patient (Lindström et al., 2014). A systematic review found that less than half of patients suffering an acute coronary syndrome attributed the experienced symptoms to a cardiac cause (Birnbach et al., 2020), indicating the challenges patients are facing when trying to understand what the experienced condition is an expression of. Moreover, patients might not possess the same language as health professionals to describe medical problems and may depend on having heard about typical symptoms associated with heart disease.

The setting of telephone consultation is efficient in situations where the patient is stating a clear and well-defined medical problem and is competent in communicating with the call-taker (Yliluoma & Palonen, 2020). By contrast, among patients suffering an OHCA, the call-taker's recognition was affected negatively by various descriptions of the OHCA (Richards et al., 2022). Similarly, a cohort study found that atypical symptom presentation (without chest pain) is common among patients suffering an acute MI (Li & Yu, 2017), and absence of chest pain among patients suffering a MI is found to reduce the chance of survival (A. L. Møller et al., 2021).

Taken together, this describes the challenges the setting of telephone consultations might cause when assessing the severity of a reported condition and deciding on a response for further treatment.

## 1.5 RATIONALE FOR THE STUDY

As the prehospital setting of telephone consultations plays an increasing role, research in identification of challenges is warranted. Existing research focus on the call-taker's perspective, for example, ethical dilemmas and facilitators and barriers in the decision-making on choice of response (Alfsen et al., 2015; I. Holmström & Höglund, 2007; I. K. Holmström et al., 2021; Palsgaard Møller et al., 2021; Wouters et al., 2020). Communication quality has also been explored, mainly from a quantitative perspective (Derckx et al., 2009; Gerwing et al., 2021; Graversen et al., 2020).

Less is known about how the patients and call-takers react to early signs of development of MI and OHCA regarding how the patients' experienced conditions are observed and interpreted by both patients and call-takers, and what characterizes the communicative interaction leading to a decision on choice of response. Survival among patients suffering an OHCA is low (Gräsner et al., 2016, 2020) and among patients suffering a MI, several are not recognized (Li & Yu, 2017). This leads to exploring the communicative interaction between patients and call-takers in a setting that avoids depending on patients being alive or being able to remember what had happened.

Contrary to a quantitative research design with a focus on recording symptoms (Gnesin et al., 2022; A. L. Møller et al., 2021; Zyllyftari et al., 2022), a qualitative

research design can contribute with knowledge on how patients' and call-takers' understand the severity of the patients' experienced conditions.

Knowledge on how patients and call-takers interpret the severity of the patient's experienced condition together with insight into the communicative interaction might identify areas where the existing practice could be improved to identify patients suffering a severe condition. Faster recognition of severe conditions warranting hospital referral could be facilitated by exploring how patients experience their condition together with an examination of the decision-making process.

Patient is used as a joint denomination of the caller in paper 3 (B. Jensen et al., 2022) and caller is used in papers 1 and 2 (B. Jensen et al., 2022, 2023a). In this PhD study, however, the person who is making the call to the Copenhagen EMS is referred to as the patient. Although it is not always the patients themselves who call but a spouse, relative, or a bystander, the patients are asked to participate in the telephone consultations by the call-takers. Following this, in almost all calls the patient participates during the telephone consultation (B. Jensen et al., 2022, 2023a, 2023b).

## 1.6 OVERALL OBJECTIVE AND RESEARCH AIMS

The overall objective of this PhD study is to gain knowledge on how patients observe, describe, understand, and interpret early warning signs of MI and OHCA expressed in telephone consultations preceding suffering a MI and OHCA. In addition to this, to gain knowledge on how call-takers react to the patients' experienced condition through observation of the decision-making process on choice of response.

Three research aims form the basis for the overall objective and are addressed in three separate papers:

1. To explore characteristics in callers' interpretation of experienced conditions where an evolving MI was not initially recognized, and how the callers described the conditions in the telephone consultations (B. Jensen et al., 2023a) (paper 1).<sup>1</sup>
2. To explore what characterized the development in the call-taker's decision-making process as it was expressed in the communicative interaction between caller and call-taker (B. Jensen et al., 2023b) (paper 2).<sup>2</sup>
3. To explore how communication between patient and call-taker influenced the call-taker's interpretation of the patient's back pain descriptions and

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<sup>1</sup> Caller is equivalent to patient in this PhD dissertation.

<sup>2</sup> Caller is equivalent to patient in this PhD dissertation.

implementation of treatment in telephone consultations within 24 hours before the patient suffered an OHCA (B. Jensen et al., 2022) (paper 3).

## CHAPTER 2. METHODOLOGY

Drawing on Luhmann's constructivism (Luhmann, 1990), the PhD study is based on the methodical constructivism as outlined by Roar Hagen (Hagen, 1997). In this chapter central characteristics of constructivism are introduced. Afterward, key aspects of social systems theory by Luhmann as theoretical framework is outlined (Luhmann, 1995, 2012, 2013), including explanations of why this approach was chosen. Lastly, it will be explained how the chosen approach is applied and how it affected the collection, analysis, and interpretation of data.

### 2.1 CONSTRUCTIVISM AS A PHILOSOPHY OF SCIENCE

The philosophy of science encompasses reflections on how it is possible to gain knowledge about the world and how to gain access to reality (Jarvie & Zaamora-Bonilla, 2011). According to Luhmann's form of constructivism (Luhmann, 1995), any form of knowledge about the world is always observer determined, i.e. any kind of understanding, description or cognition is related to an observer's particular way of observing something. The basic premise is that the world cannot be understood independently of an observer's way of observing and that every observation is based on the application of a distinction. Observations can be divided into two forms, first-order and second-order observations. Observations by means of a distinction refer to Spencer Brown's understanding of observing by drawing a distinction (Spencer Brown, 1979). The construction of a distinction is based on an initial observation that separates the space into two sides, while simultaneously indicating one of the two sides (Baraldi et al., 2021). Hence, one side is actualized as "this-and-not-something-else" (Luhmann, 1995, p. 66), corresponding to a first-order observation. A second-order observation is characterized by an observation of the distinction used in the first-order observation. This makes it possible not only to see what is observed in the first-order observation but also why it is observed (N. Å. Andersen, 1999; Baraldi et al., 2021; Luhmann, 1990). An example of a first-order observation is when a call-taker at the Copenhagen EMS observes a symptom based on the distinction between severe/not severe condition. A first-order observation is thus when one of the two sides is chosen. A second-order observation is when the call-taker observes their first-order observation about e.g., not severe condition and reflects on whether the first-order observation should be maintained, i.e., that the condition is still described as not severe, or whether the condition can be seen as severe, warranting hospital referral. Hence, an interpretation of the experienced condition occurs. This observation-based approach provides an opportunity to reflect on blind spots. Blind spots refer to the difference that underlies an observation, e.g., the distinction between severe/not severe condition, a difference that makes one blind to other differences that can become 'visible' via reflection, i.e., second-order observations. With the example in mind, meant that there is reflection on whether the conditions which are described as not severe could be indications of something severe, or that the overall picture of symptoms could indicate something severe. A call-taker at the Copenhagen EMS designates symptoms equivalent to a severe condition warranting hospital referral, which thus takes centre stage in the communicative interaction with the patient and

becomes visible while everything else takes place in the background. What has fallen into the background at the first distinction can be actualized, i.e., made observable by means of a new and different distinction. Reality thus appears to an observer in relation to the differences the observer uses to observe with. Following this, any understanding of reality will always be related to an observer who sees something in a particular way qua the particular way the observer observes (Baraldi et al., 2021; Luhmann, 1990).

The use of methodological constructivism thematises a constructivist self-perception in the form of reflection on the researcher's own choices in the research process (Hagen, 1997). More specifically, it takes place by distinguishing between theory, methods and empirical knowledge and reflecting on these choices and relations. Hagen explains the relationship between theory, empiricism, and theory of science in the following extract:

*“The social sciences have three elements: theory, empiricism and, thirdly, a reflection on the relationship between theory and empiricism called method, methodology or theory of science” (Hagen 1997, p. 3).*

In this context, methodology reflects the relationship between empirical observations and fundamental assumptions of the commutative interaction and thereby gives the theory a central role, since it is a theory that points to the choice of method, and thus the production of data in the form of empiricism. Furthermore, the key question in this approach is to what extent the scientific concepts are suitable for empirical analysis (Hagen & Gudmundsen, 2011).

From a constructivist epistemological perspective, the focus is on *how* the observer observes through second-order observation, thereby observing cognition as the observing system's construction (Hagen, 1997; Hagen & Gudmundsen, 2011). In this PhD study, the observed reality is the communicative interaction between patient and call-taker, and this is done by using a communication concept which is presented later in section 2.2.1 *Communication*. Through observation of the communicative interaction between patient and call-taker, I as a researcher conduct a second-order observation of how the patients and the call-takers observe and interpret the severity of the reported conditions. The call-taker's decision-making process on choice of response allows a second-order observation of the call-taker's interpretation of the severity of the reported condition. The constructivist epistemological approach makes it apparent that there is no access to reality as such/on its own; yet, the approach does not dismiss the concept of reality, even though there is no access to reality, other than through the observer's observations of reality (Baraldi et al., 2021). In this case, my observations of and interpretations of the communication in the telephone consultations. Following this, I as a researcher do not have direct access to the patient's experienced condition only the patient's observations and interpretation of the experienced condition as it is expressed in the communication (*cf. figure 4*). It, however, does not reject the reality of the actual condition in the body.

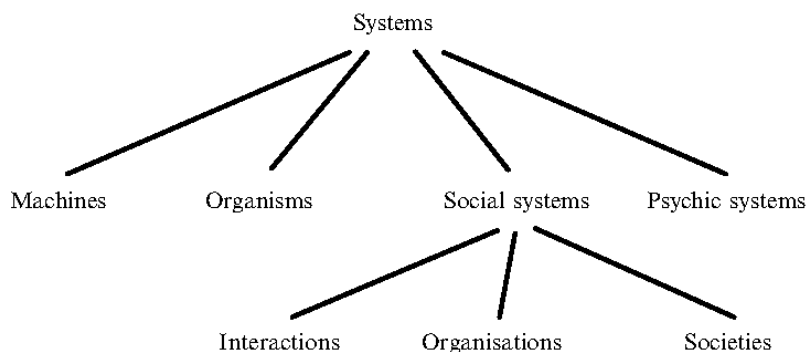
Hagen's argument for working with methodological constructivism is to identify the process of reflection and give it a name, thus strengthening the connection between theory and empiricism in the subject of sociology by showing that they are connected via the use of distinctions. Both sides of the distinction between theory and empiricism are independent and necessary elements in the research process. As a result, the scientists construct empirical data through choices made about what samples are chosen or who and how people are asked, hence different choices could have been made by scientists, and through this the science. In the context of the PhD study, I as a researcher apply theory to understand the empirical reality.

## 2.2 THEORETICAL FRAMEWORK

The thesis is theoretically informed by Niklas Luhmann's social systems theory (Luhmann, 1995). According to Luhmann, the world can be seen as consisting of systems:

*" Thus the statement "there are systems" says only that there are objects of research that exhibit features justifying the use of the concept of system, (...) "*  
(Luhmann, 1995, p. 2).

Rather than claim that the world consists of systems, Luhmann's statement offers a theoretical assumption for empirical observation. Luhmann's understanding of different types of systems is presented in figure 1.



**Figure 1.** Overview of different type of systems, according to Luhmann (Luhmann, 1995, p. 2)<sup>3</sup>.

This PhD study draws on all types of systems but machines. All systems are external to each other regardless of system type. A further difference is that the different system types are external to each other since they operate in different media, which

<sup>3</sup> Societies are equivalent to function systems (Luhmann, 1995).



does not mean that they are of no importance to each other. In short, organism represents the patient's body that operates in the media life, and the psychic system that operates in the medium of consciousness and represents an individual i.e., the patient or the call-taker. All three social systems operate in the media communication. Interaction system represents in this PhD study a telephone consultation, and the Copenhagen EMS represents an organisation system. The three types of social systems are elaborated in section 2.2.2 *Types of social systems*.

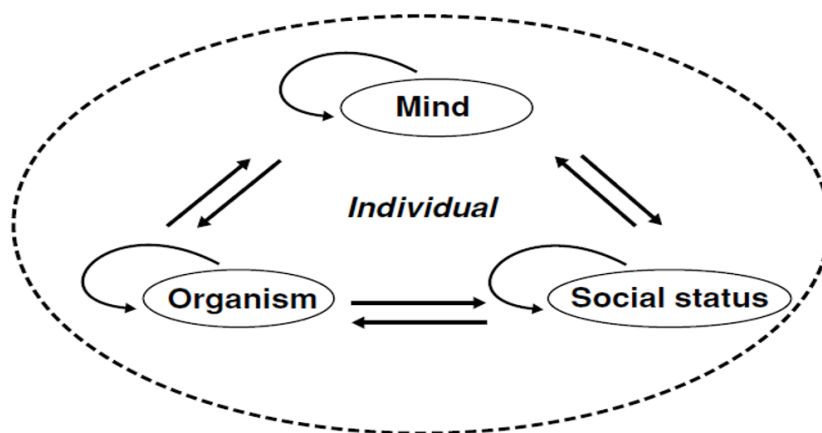
Luhmann uses the concept of autopoiesis understood as self-reference to establish the unity of a system by operations only produced and re-produced by the system without direct input from the environment. The term environment denotes everything that is not part of a system (Baraldi et al., 2021; Luhmann, 1995). A telephone consultation consisting of a patient and a call-taker can be understood as an interaction system. The telephone consultation is operationally closed as the interaction in the telephone consultation only is produced and re-produced through the communication between the participants in the telephone consultation. Communication as a concept is described in further detail in section 2.2.1 *Communication*.

As the world can be understood as composed of systems, the distinction between system and environment becomes the guiding principle. A system can only be determined by a distinction from its environment, here denoting everything other than the specific system, which is why every system has its own environment. Both psychic systems and social systems are meaning-constituting systems but belong to each other's environment. Psychic systems operate in the media consciousness in the form of thoughts that are reproduced exclusively in the mind. Hence, psychic systems consist of consciousness given operationally closed production and re-production of more or less clear thoughts. Social systems operate in the medium of communication and produce and reproduce themselves exclusively by linking communication to communication (Baraldi et al., 2021; Luhmann, 1995). Following this, a psychic system is operationally closed by the production and reproduction of thoughts within the mind, and a social system is operationally closed by the reproduction of communication within the social system (Baraldi et al., 2021; Luhmann, 1995). Or put another way, thoughts cannot operate in communicative processes, and communication cannot operate in consciousness.

Even though systems are each other's environment they are making their complexity available to each other, i.e., systems can be understood as being structurally coupled (Luhmann, 1995), and explains how psychic systems are essential for the reproduction of social systems as communication depends on conscious thinking making complexity available to the operations of the social system. In other words, consciousness and communication only exist given structural coupling (Baraldi et al., 2021; Luhmann, 1995, 2012).

Based on Luhmann's social systems theory, a human being is understood as constituted by three autopoietic systems that produce and re-produce themselves: an organism or body, a mind or consciousness, and social status or a person (Pelikan,

2007). The body produces and reproduces metabolic processes, the consciousness represents the psychic system as it produces and reproduces thoughts, and the person's social status is produced and reproduced through communicative interaction with other persons. As each of the three autopoietic systems operates according to different basic operations with different environments and in different media, they cannot be reduced to each other (Pelikan, 2007). An illustration of the interplay between the three systems constituting a human being is presented in figure 2.



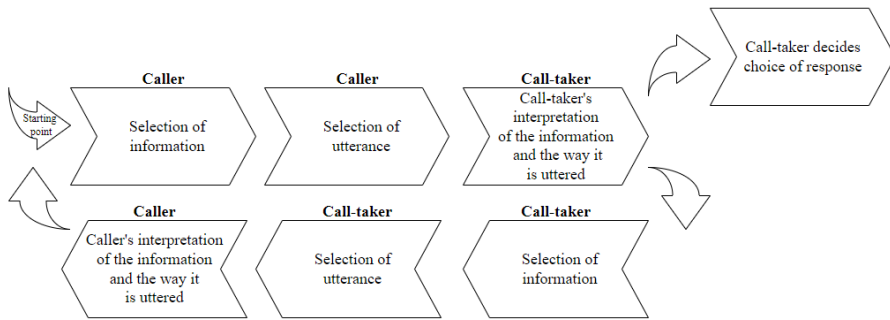
**Figure 2.** The human being understood as three structural coupled systems: organism (body), mind (consciousness), and social status (person) (Pelikan, 2007, p. 83).

Related to patients suffering a MI or an OCHA, the concept of the human being as constituted by three different systems can be used to explain the challenges in relation to identifying a severe condition warranting hospital admission, both from the patient's perspective and the call-taker's perspective. The autopoietic system of the organism represents an existing condition or symptoms in the body. As the psychic system can be understood as a meaning-constituting system based on thoughts and not metabolic process, the psychic system does not have direct access to the body's condition. However, due to the structural coupling, the psychic system interprets the body's condition and uses that interpretation via the structural coupling to communicate about the interpretation of the experienced condition to the call-taker in the telephone consultation.

### 2.2.1 COMMUNICATION

In social systems theory, communication is observed as a synthesis of a three-part selection: information, utterance, and understanding or misunderstanding of the uttered information (Baraldi et al., 2021; Luhmann, 2002b, 2012). Following this,

communication is not merely a transfer of information from one person to another. By drawing a distinction between what is uttered and what is not uttered, information is defined by a selection of information among a continuum of possible information. A participant in a social system selects a piece of information and selects how the information is uttered then another participant understands or misunderstands the uttered information which gives occasion for further communication (Baraldi et al., 2021; Luhmann, 2002b, 2012). An illustration of the communicative interaction in telephone consultations between patient and call-taker based on synthesis of communication is presented in figure 3. In article 2, caller is a designation of the patient (B. Jensen et al., 2023b).

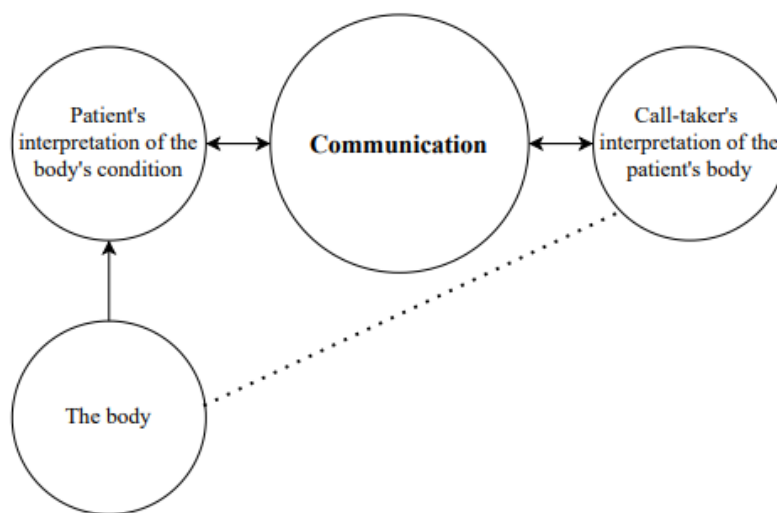


**Figure 3.** The communicative interaction in telephone consultations between caller and call-taker. The communicative interaction can consist of several syntheses of communication before the call-taker decides a choice of response. This is reflected in the duration of each telephone consultation (B. Jensen et al., 2023b)<sup>4</sup>.

In telephone consultations, a distinction between selection of information concerning the experienced condition and other information is drawn as the purpose of the telephone consultations is to receive assistance concerning a medical problem.

When applying Luhmann's theory, the meaning construction of psychological and social systems is understood as an expression of an interpretation or put another way as a construction. That it is a construction does not refer to what is right or wrong, but only that it is a construction in the sense of a possible construction or interpretation among other possible ones. It is only through observation of the communicative interaction is it possible to gain access to the patient's and call-taker's interpretation of the patient's experienced condition. An illustration of the communicative interaction in telephone consultations between patient and call-taker concerning the patient's experienced condition as the reality available for empirical research is presented in figure 4.

<sup>4</sup> Caller is equivalent to patient in this PhD dissertation.



**Figure 4.** Telephone consultation as a meaning-constituting interaction system where interpretation of the patients' experienced condition is only possible by observing the communication between patient and call-taker. The dotted line illustrates that the call-taker has no direct access to the patient's body and thus experienced condition.

## 2.2.2 TYPES OF SOCIAL SYSTEMS

According to Luhmann, the modern society can be characterized by functional differentiation (Luhmann, 1995, 2013). Function systems are not defined by social demarcation, they are closed in regard to their function (N. Å. Andersen, 2003; Hagen, 2006). The political system, the economic system, the education system, and the health system are examples of different function systems. In addition, different function systems are equal in the sense that no function system is attached with more importance than the others (Luhmann, 1995). While the health system only is relevant and functions when someone is sick or is at risk of being sick based on the distinction presence/absence of disease referring to the program diagnoses (Pelikan, 2007), it depends on other function systems given the knowledge of disease depends on the scientific function system's production on knowledge about sickness and what may cause sickness e.g., risk factors. In addition, the education system educates health professionals, and allocation of resources depends on the economic system. The communication between doctors and patients are structured based on the presence/absence of disease distinction as the function of drawing a distinction between presence/absence of disease solely lies within the health system, the function cannot be fulfilled anywhere else in the society (Baraldi et al., 2021; Pelikan, 2007).

Apart from function systems, there are two other types of social systems: organisation and interaction (*cf. figure 1*). Organisation systems are constituted by rules of

admission; hence, organisations operate in the form of decisions. To be able to make decisions and evaluate the correctness of the decisions, organisations employ specific programs for decision-making. Furthermore, the binding character attached to decisions in organisations is warranted only by particular communication channels (Baraldi et al., 2021; Luhmann, 2013). The Danish healthcare system can be understood as an organisation where patients are not members of the organisation but gain access to the services of the organisation by fulfilling the criteria of being ill if they have a disease in accordance with the systems inner criteria on the presence/absence of disease distinction. Following this, the prehospital setting of telephone triage at the Copenhagen EMS can be understood as an interaction system on behalf of an organisation system, in this case the healthcare system. In the prehospital setting, a distinction between severe/not severe condition, a secondary code to the presence/absence of disease distinction, is applied as a medical diagnostic selection mechanism as the function of the prehospital setting is to decide whether a patient's condition warrants hospital admission based on the distinction between severe/not severe condition.

To explore the decision-making process in the telephone consultations, Luhmann's understanding of the risk/danger distinction is applied (Baraldi et al., 2021; Luhmann, 2002a, 2012). Traditionally, risk is understood as a counter-concept to security; however, risk is ubiquitous as there is no risk-free behaviour (Baraldi et al., 2021; Luhmann, 2002a). The concept of risk/danger depends on the perspective by which it is observed. Risk is the concept of possible future damages caused by decisions made in the present and danger is understood as possible damage attributed to the affected party caused by the decision (Baraldi et al., 2021; Luhmann, 2002a, 2012). Risk is observed from the decision-maker's perspective and danger is from the perspective of the affected party, however, the decision-maker and the affected party can be the same person as well as two different persons. From the patient's perspective, the patient's decision to call the Copenhagen EMS can be understood according to the risk/danger distinction. The patient might be at risk of suffering a severe condition in the near future if the patient does not react to the experienced condition by calling the Copenhagen EMS. Following this, the patient is also the affected party, because it is the patient who might be in danger of suffering a severe condition if the patient does not seek medical attention. On the other hand, the risk/danger distinction can also be understood referring to the call-taker as the decision-maker. The call-taker may be at risk of misinterpreting the severity of the patient's condition leading to no offer of hospital referral causing the patient to be in danger of suffering a severe condition.

Systems of interaction are expressed as a communicative system defined as limited in time, as well as limited processing of complexity (Luhmann, 1995). While systems of interaction are defined by the distinction between present/absent, it follows that the participants must be present simultaneously and when the interaction is completed and the participants leave the interaction system dissolves (Baraldi et al., 2021). Furthermore, the role of each participant in the interaction system is expected to be taken into account in the interaction (Luhmann, 2013). Following this, telephone consultations can be observed as interaction systems on behalf of an organisation, the

Danish healthcare system, constituted by a patient and a call-taker with a clear definition of role assignments as the patient calls the Copenhagen EMS due to a perceived medical problem and the call-taker makes decision about choice of response on behalf of the health system. As soon as the telephone consultation is completed, the interaction system dissolves again. If a patient calls again, a new interaction system is established and the communication in the newly established interaction system depends on whether the call-taker is identical to the call-taker in the previous call.

Another central element is the concept of “double contingency” referring to the position that each psychic system in an interaction could be possible in another way (Baraldi et al., 2021). In the context of telephone consultations, double contingency refers to the possibility that the patient could have reported different conditions or reported the conditions differently and the call-taker could have asked different questions or asked the questions differently which might lead to a different decision-making process on the choice of response. Following this understanding, the patient’s condition can be understood as being constructed through a communicative interactive negotiation in the telephone consultations based on a medical diagnostic selection mechanism.

Further elaboration of how the presented aspects of social systems theory will be applied in this PhD study is presented in section 2.6 *Data analysis*.

## 2.3 STUDY SETTING

The Copenhagen EMS is part of the Capital Region of Denmark and serves 1.8 million inhabitants. The Copenhagen EMS consists of a co-located service, the 1813-medical helpline, and emergency number 1-1-2 (“Capital Region of Denmark Growth and Quality of Life,” 2017). While the emergency number 1-1-2 is to be contacted in case of emergencies warranting dispatch of ambulances and treatment in hospital, the 1813-medical helpline is a 24-hour medical helpline, which is to be contacted with non-emergency medical conditions. The function of the 1813-medical is to triage the medical conditions into categories of priority for treatment. Lowest priority for treatment is guidance and may result in recommendations of ‘selfcare’, ‘watchful waiting’, or ‘contact your general practitioner’ indicating a medical problem not interpreted as severe by the call-taker. In cases of more severe medical problems warranting higher priorities, the 1813-medical helpline may refer to emergency departments or dispatch ambulances (Lindskou et al., 2019; Zinger et al., 2022). Specialised nurses, paramedics, and physicians function as medical service dispatchers (call-takers). Based on decision support tools, Danish Index system in the emergency number 1-1-2 (M. S. Andersen et al., 2013) and a locally developed electronic system in the 1813-medical helpline (Lindskou et al., 2019), questions about symptoms guide triage screening and thus decisions about inclusion or exclusion regarding offer of hospital referral. The Danish Index is organised into 37 criteria equivalent to symptoms, clinical signs, or incidents to decide response based on level of urgency (Lindskou et al., 2019). The electronic decision support tool used

in the 1813-medical helpline is developed based on the Danish Index system, a Danish handbook in emergency medicine [Akuthåndbogen], and guidelines from the Danish Health Authorities (Statsrevisorerne, 2017; Vinge og Susanne Reindahl Rasmussen, 2018).

Rather than assigning the patient a diagnosis during the telephone consultation, the function of the decision support tools is to determine the severity of the reported medical problem (Lindskou et al., 2019), based on pattern recognition as part of the diagnostic process (Wing & Schiffman, 2021). Furthermore, decision support tools function as legal documents to record evidence of decisions and to ensure patient safety (Vinge og Susanne Reindahl Rasmussen, 2018). While it is mandatory for nurses working at the 1813-medical helpline to use the decision support tool in all telephone consultations, physicians are excepted (Statsrevisorerne, 2017). However, physicians frequently apply the decision support tool as an assessment manual (Vinge og Susanne Reindahl Rasmussen, 2018). Moreover, it is possible for nurses to forward calls to a physician if the condition is complex and in need of further medical assessment. This happens in 11% of all calls answered by nurses (Statsrevisorerne, 2017).

## 2.4 SAMPLING

To gain knowledge about interpretation of experienced conditions through communication in telephone consultations from the patient and call-taker perspectives and the decision-making process concerning patients turning out to suffer severe conditions such as MI or OHCA, stratified purposive sampling strategy was used to select participants (Patton, 2015). Stratified purposive sampling facilitates selection of specific groups (Patton, 2015), which is in line with the research aim of exploring characteristic in the communicative interaction between patients and call-takers among specific groups of patients, cf. section 1.6 *“Overall objective and research aims”*.

The PhD study had access to telephone calls at the Copenhagen EMS in a three-year period from 2016 to 2018 among patients suffering a MI or an OHCA. In Denmark, all Danish residents receive a Danish Civil Registration Number at birth (M. Schmidt et al., 2019). This number is a unique personal identifier, which allows Copenhagen EMS to identify the patient and enables linkage across different registries. Patients diagnosed with MI in 2018 as stated in ICD-10 classification at discharge were identified in the Danish National Patient Registry (M. Schmidt et al., 2015) and patients suffering an OHCA from 2016-18 were identified in the Danish Cardiac Arrest Registry (Wissenberg et al., 2013). Audio files of telephone consultations were stored at the Copenhagen EMS. Furthermore, an administrative database at the Copenhagen EMS contains information on all calls linked to a specific Danish Civil Registration Number. Among other measures, the administrative database includes information on total number of contacts to the Copenhagen EMS and for each contact: date and time, total talk-time, and the response chosen by the call-taker. Moreover, the call-taker is to register a main complaint for each call, hence, the call-taker selects

which symptom that is interpreted to encompass the severity of the reported condition. If a nurse forwarded the call to a physician within the 1813-medical helpline, a call was transferred from the 1813-medical helpline to the emergency number 1-1-2, or from the emergency number 1-1-2 to the 1813-medical helpline, the call is registered as two separate contacts. Identification of the role of the patient and the call-taker's profession was possible when listening to the calls. In some calls, the caller was not the patient but a spouse, a relative, or a bystander. According to protocol, however, the call-taker asks to speak with the patient, if the patient is not the caller. Following this, as illustrated in paper 1, in 93 % of the calls the call-taker spoke with the patient (B. Jensen et al., 2023a).

Paper 1 and paper 2 are based on the same patients. As a result of linkage between different registries, as described above, patients who at least twice had been in contact with the Copenhagen EMS up to one week before they were diagnosed with MI were identified. Then, the patients who 1) were referred to 'selfcare', 'watchful waiting', or 'contact your general practitioner' in the penultimate call and 2) where the last contact resulted in hospitalization were selected. In paper 1, the penultimate call before hospitalization was analysed (B. Jensen et al., 2023a). In paper 2, both the penultimate and the last call before hospitalization was included in the analysis (B. Jensen et al., 2023b). Paper 3 are based on patients suffering an OHCA within 24 hours after the last contact to the Copenhagen complaining of back pain during the call (B. Jensen et al., 2022). Patients reporting back pain were identified in a concurrent project where symptoms were registered using a developed survey guide while listening to calls (Gnesin et al., 2022).

The number of patients included in this PhD study was guided by the concept of information power (Malterud et al., 2016). A combination of a specific research aim focussing on two well-defined patient groups holding specific characteristics, the use of established theory deemed highly relevant, and application of an analysis strategy, with clear criteria on amount of material for analysis (cf. section 2.6. *Data analysis*) guided the selection and resulted in successful selection of 37 patients.

## 2.4.1 SUPPLEMENTARY OBSERVATIONS

To gain insight into the setting of Copenhagen EMS and how the call-takers conduct telephone consultations, I was on a one-day site visit at the Copenhagen EMS where I listened in on calls. This was a weekday in the beginning of my PhD study before I started to listen to calls relevant to this PhD study. For the first part of the day, I followed a paramedic at the emergency number 1-1-2 and for the second part of the day, I followed a nurse at the 1813-medical helpline.

Through observations of the telephone consultations, I obtained insight in how the call-takers handled the communicative interaction and how they navigated the decision support tools. Informal conversations with the call-takers contributed with knowledge about the call-taker's perspective in relation to conducting telephone consultations together with presentation of the working station setup, especially how



different electronic systems interacted to facilitate the decision-making process but also how the call-taker was able to share information with the ambulance personnel.

Prior to the data collection of calls selected for this PhD study, I listened to a range of calls with patients suffering an OHCA to get familiarized with this specific field. Although the observations at the Copenhagen EMS and the initial monitoring of calls were not part of the data collection process, they can be understood as an aspect of the data-gathering process (Patton, 2015) and contributed with valuable knowledge of the research field.

## 2.5 ETHICAL CONSIDERATIONS

According to Danish legislation, registry-based research does not require Research Ethical approval (*Act on Research Ethics Review of Health Research Projects*, 2018). Therefore, no informed consent was requested. The PhD study, however, complied with the ethical principles of the Helsinki Declaration to protect the selected patients' integrity (The World Medical Association, 2013).

The European General Data Protection Regulation (The European Parliament and the Council of the European Union, 2016) is implemented through the Danish Data Protection Act. The Danish Data Protection Act allows research in person identifiable administrative data (C. Schmidt, n.d.). The PhD study was approved by the data responsible authority, Capital Region (Approval number: P-2019-191), and the Danish Patient Safety Authority (Case number: 3-3013-2795/1, reference: EMGW). The administrative data and the audio files are owned by the Copenhagen EMS; hence, data does not leave the Capital Region. The transcripts, however, are owned by Aalborg University through a data processing agreement.

Even though the PhD study is register-based, different measures were taken to protect the identity of all participants in all selected telephone consultations. In all three papers, the patients' names were anonymized. In paper 1, the age of the patients was also masked (B. Jensen et al., 2023b). The call-taker's profession does not appear in any of the papers. Any bystanders that may participate in the telephone consultations were also anonymized, only referred to by their role, e.g., wife (B. Jensen et al., 2022, 2023a, 2023b).

Given the nature of the empirical data in the form of audio recordings, I had access to telephone consultations that may be potentially life-threatening. Through the process of getting acquainted with the material, as described in section 2.4.1 *Supplementary observations*, I listened to calls containing distressing situations. I coped with listening to distressed calls by discussing my experiences with trusted colleagues within the research team. Following this, it was important to preserve a professional critical detachment to the distressed situations I might observe. To protect the patients' integrity throughout the research process I critically assessed whether calls containing distressed situations i.e., calls dealing with the actual MI or OHCA would contribute with valuable knowledge concerning reaction to early signs of development of MI or

OHCA. In calls concerning heart arrest, the call-taker's attention was focused on guiding the caller to perform cardiopulmonary resuscitation. Hence, based on the objective to understand reaction to early signs of development of MI and OHCA, the selected telephone consultations for analysis did not concern the actual MI or OHCA.

## 2.6 DATA ANALYSIS

In this study, an epistemological understanding of the analytical strategy is applied, as it is I as researcher who constructs the patient's and call-taker's observations of the patient's experienced condition as object for my observations, hence conduct a second-order observation (N. Å. Andersen, 1999; Baraldi et al., 2021; Luhmann, 1990). Through a second-order observation, it becomes possible to observe not only *what and how* patients and call-takers describe and utter what they do, but also *why* they describe and utter what they do, thus conducting a second-order observation of reactions to early warning signs of development of MI or OHCA. Through the distinction between severe/not severe condition as a medical diagnostic selection mechanism, a second-order observation of the patients' and call-takers' observations regarding the patients' experienced conditions are constructed. Luhmann's understanding of communication as a three-part synthesis consisting of selection of information, selection of utterance and selection of understanding or misunderstanding (Baraldi et al., 2021; Luhmann, 2002b, 2012) makes it possible to observe which symptoms the patients describe, how the symptoms are described and the patients' understanding of what the experienced condition is an expression of. In this way, it becomes possible to explore what and how the patients experience and interpret their conditions through observations of the communicative interaction with the call-taker. Based on the distinction between severe/not severe condition, a second-order analysis of the patients' interpretation of the severity of the experienced condition is thus conducted. Similarly, the call-takers' selection of understanding of the patients' reported conditions leading to an interpretation of the severity is explored by observing the call-takers' reactions to the patients' uttered conditions. Following this, based on the distinction between severe/not severe condition as a medical diagnostic selection mechanism, a second-order analysis of what the call-taker observes and how the call-takers interpret the severity of the patients' reported conditions reflected in the decision-making process on choice of response is conducted. Taken together, a social system theoretical approach offers an opportunity to explore multidimensional aspects of the communicative interaction to understand patients' and call-takers' reaction to early warning signs of development of MI or OHCA.

Furthermore, an abductive research strategy is provided for generating new knowledge. According to Hagen and Gudmundsen (Hagen & Gudmundsen, 2011), abductive reasoning is the research logic applied to epistemological constructivism. Based on Blaikie (Blaikie, 2007), abduction is defined as the process in which the researcher discovers the construction of reality by observing the interaction of social actors (Blaikie, 2007), in this PhD study the patient and the call-taker. Furthermore, abduction is a way to evaluate and develop scientific concepts based on the effect of

the empirical analysis; in other words, how suitable the scientific concepts are to conduct an analysis of the empirical knowledge and thereby encourages exchange of theoretical and empirical research (Hagen & Gudmundsen, 2011).

By applying this approach in my research, I started with a one-day visit to the Copenhagen EMS, cf. 2.4.1 *Supplementary Observations*. Afterward, I listened to recorded telephone consultations, especially how patient and call-taker interacted during telephone consultations concerning OHCA, to gain practice experience with one of the target groups in the PhD study. This gave way to reflections on useful scientific concepts for analysing patients' and call-takers' reaction to early warning signs of development of MI or OHCA. Reflection on empirical knowledge and theory qualified the selection of scientific concepts, hence it was the usefulness of scientific concepts to analyse the empirical knowledge that determined which concepts were chosen for the analysis. As outlined above, this is consistent with the methodical constructivism by Roar Hagen (Hagen, 1997). The initial observation of the interaction between patient and call-taker and methodical constructivism gave way to draw on theory concerning communication based on Luhmann's system theoretical approach, as it provides scientific concepts in the form of system/environment distinction as well as understanding of communication as synthesis of information, utterance and understanding or misunderstanding (Baraldi et al., 2021; Luhmann, 1995, 2002b, 2012).

Based on the overall objective of the PhD study, stratified purposive sampling strategy (Patton, 2015) was used to select patients to analyse the communicative interaction in the telephone consultations, cf. section 2.4 *Sampling*. To get a comprehensive understanding of patients' and call-takers' reaction to early warning signs of development of MI or OHCA calls without offer of hospital referral and calls resulting in dispatch of ambulance were chosen (B. Jensen et al., 2022, 2023a, 2023b). The process of transcribing the selected calls gave way to a unique understanding of the content of the calls including verbal and non-verbal utterances such as shortness of breath or tone of voice. Paralanguage, however, was not consequently transcribed, thus, played a minimal role in the analyses.

The abductive research strategy gave way to reflections on specific research questions for each paper included in the PhD study and the principles of qualitative content analysis were used to build coding frames for each paper (Schreier, 2012). Simultaneously with the process of listening to, selecting, and transcribing calls, considerations of content of the coding frame for each paper were made. In line with an abductive approach, subsumption strategy was applied in paper 1 and 3, where main categories were generated based on the research question, and subcategories were generated inductively based on the empirical material (Schreier, 2012). The first step in subsumption strategy was to develop main categories each embracing different aspects of the research question. Then, the next step was to go over the material looking for concepts relevant for answering the research question. When a concept was relevant it was subsumed into a subcategory under the relevant main category (Schreier, 2012). In paper 2, a combination of subsumption strategy and elements of

contrasting strategy was applied (Schreier, 2012), because the research question was to explore characteristics in the development in the call-takers’ decision-making process on choice of response in the penultimate call compared to the last call (B. Jensen et al., 2023b). Elements of contrasting strategy were used to identify differences and similarities between calls.

When new material does not offer new insights or categories, saturation has been reached and no more material is needed (Schreier, 2012). This point was reached with 21 patient in paper 1, 19 patients in paper 2, and 17 patients in paper 3 (B. Jensen et al., 2022, 2023a, 2023b).

A detailed illustration of the coding frame generated for paper 1 is shown in table 1. In paper 1, the research question was to explore the patients’ interpretation of the experienced condition through communication with call-takers (B. Jensen et al., 2023a). The research question together with Luhmann’s theory on interpretation and construction of meaning contributed to identifying which aspects the analysis focused on. Each dimension represents three aspects of the patient’s interpretation of the experienced condition as it was expressed in the communicative interaction with the call-taker. In line with Schrier’s understanding, subsumption is used if you already have some idea of what you are looking for (Schreier, 2012). The first dimension “Factors contribution to patient’s construction of meaning” was the starting point of the analysis and was generated first. Based on the theory and through that the role of the communicative interaction in the telephone consultations, the second and third dimension (“Patient’s reaction to interpretation of condition” and “Negotiation of interpretation”) were generated. The aspects were concept-driven, but the subcategories were data-driven. Moreover, the final concepts were developed during the pilot phase.

**Table 1.** Illustration of the coding frame generated with subsumption strategy, including examples of the link between context units, units of coding, subcategories, and main category. The main categories are concept-driven, and subcategories are data-driven (B. Jensen et al., 2023a)<sup>5</sup>.

Context units <sup>1</sup>	Units of coding <sup>2</sup>	Subcategory	Main category
Call-taker:  and he has no radiation to the jaw or the left arm?	“I immediately thought of the heart department [wife addressed Alex], but there is no radiation to	<b>Awareness of illness</b>  <u>Definition:</u>  The category applies if the caller refers to a	<b>Factors contributing to caller’s construction of meaning</b>

<sup>5</sup> Caller is equivalent to patient in this PhD dissertation.

<p>Alex's wife:</p> <p>I immediately thought of the heart department [wife addressed Alex], but there is no radiation to the neck or arms, is there?</p> <p>Alex's wife [to the call-taker]:</p> <p>no, but hot flashes</p>	<p>the neck or arms, is there?"</p>	<p>condition or knowledge of a disease</p>	<p><u>Description:</u></p> <p>Given the concept-driven understanding of telephone consultations as meaning-constituting interaction systems, the category includes aspects related to the caller's attempt to interpret their own experienced condition</p>
<p>Sophia:</p> <p>I saw my doctor today</p> <p>Call-taker:</p> <p>yes</p> <p>Sophia:</p> <p>and that didn't help. She just wrote a prescription for penicillin</p>	<p>"I saw my doctor today [...] and that didn't help"</p>	<p><b>Caller's own remedial actions</b></p> <p><u>Definition:</u></p> <p>This category applies if the caller describes actions taken to alleviate the experienced condition before calling the 1813-medical helpline</p>	<p><b>Factors contributing to caller's construction of meaning</b></p>
<p>Call-taker:</p> <p>are you known for high blood pressure?</p> <p>Clara:</p> <p>yes, but normally not as bad as this</p>	<p>"Yes, but normally not as bad as this"</p>	<p><b>Previous experiences</b></p> <p><u>Definition:</u></p> <p>The category applies if the caller refers to previous experiences or lack</p>	<p><b>Factors contributing to caller's construction of meaning</b></p>

		of previous experiences	
<p>Laura:</p> <p>I am an old lady, so I just wanted to, I live alone in my summer cottage. I'm calling just to be sure</p>	<p>"I'm calling just to be sure"</p>	<p><b>Unsure of interpretation</b></p> <p><u>Definition:</u></p> <p>The category applies if the caller expresses uncertainty in relation to own interpretation of the experienced condition</p> <p><u>Decision rules:</u></p> <p>Expressed in relation to unclear symptoms</p>	<p><b>Caller's reaction to own interpretation of condition</b></p> <p><u>Definition:</u></p> <p>Based on the research question's exploration of the caller's own interpretation of the experienced condition, the category includes the caller's reaction to their own interpretation</p>
<p>Call-taker:</p> <p>Does it [breathing] seem okay?</p> <p>Edward:</p> <p>it becomes worse when</p> <p>Call-taker:</p> <p>when you are in pain?</p> <p>Edward:</p> <p>maybe it's some kind of panic when it starts to</p>	<p>"Maybe it's some kind of panic when it starts to hurt, and you don't know what the hell is going on"</p>	<p><b>Worry</b></p> <p><u>Definition:</u></p> <p>The category applies if the caller expresses a reaction to the experienced condition or a specific symptom</p> <p><u>Decision rules:</u></p> <p>Expressed as concern, panic, insecurity, being scarred, or nervous</p>	<p><b>Caller's reaction to own interpretation of condition</b></p>

<p>hurt, and you don't know what the hell is going on</p> <p>Call-taker:</p> <p>yes</p>			
<p>David:</p> <p>okay ... it's because I wondered whether it was pneumonia or something like that</p> <p>Call-taker:</p> <p>no, no otherwise you wouldn't sound this way. If it were pneumonia, you would constantly be coughing</p>	<p>"Okay ... it's because I wondered whether it was pneumonia or something like that"</p>	<p><b>Caller tests call-taker's interpretation of condition</b></p> <p><u>Definition:</u></p> <p>The category applies if the caller discusses the call-taker's interpretation of the experienced condition</p>	<p><b>Negotiation of interpretation</b></p> <p><u>Definition:</u></p> <p>Based on the concept-driven understanding of telephone consultations as interaction systems, the category includes the aspect of negotiation in the caller's interpretation of the experienced condition</p>
<p>Call-taker:</p> <p>the question is how long it's [high blood pressure] going to stay up there. Try to sleep and wait and see if it's better tomorrow</p>	<p>"Try to sleep and wait and see if it's better tomorrow"</p>	<p><b>Postponement of evaluation of severity</b></p> <p><u>Definition:</u></p> <p>The category applies if either call-taker or caller suggests waiting and see</p>	<p><b>Negotiation of interpretation</b></p>

<sup>1</sup> Context units are the surrounding material needed to understand the meaning of a unit of coding (Schreier, 2012).

<sup>2</sup> Units of coding are the part of the text that fits within one subcategory (Schreier, 2012).



## CHAPTER 3. FINDINGS

In this chapter, the findings are presented in three steps. First, a description of the selected patients will be given. Second, a summary of the key findings from the three papers (B. Jensen et al., 2022, 2023a, 2023b). Third, an integrated analysis will present findings in five themes across the material.

### 3.1 PARTICIPANT CHARACTERISTICS

Overall, 37 patients were included in this PhD study of whom 14 were females aged 47 – 90 years old and 23 were males aged 42 – 84 years old. In paper 1, 21 patients (nine females and 12 males) were included, 19 patients (eight females and 11 males) in paper 2, and 17 patients (six females and 11 males) in paper 3. One patient (Bianca) was included in all three papers.

Among patients suffering an OHCA, 17 patients only had one call to the Copenhagen EMS up to 24 hours before suffering an OHCA, one patient had two calls, and one patient had three calls (B. Jensen et al., 2022). Among patients suffering a MI, 16 patients had a total number of two calls to the Copenhagen EMS up to one week before they were admitted to the hospital and subsequently diagnosed with MI (B. Jensen et al., 2023a, 2023b). In total, 60 calls made by the included patients were analysed. In the administrative data at the Copenhagen EMS calls being transferred from a nurse to a physician within the Copenhagen EMS are registered as two separate telephone consultations, even though the patient only made one call.

### 3.2 SUMMARY OF THE FINDINGS

#### 3.2.1 SUMMARY OF THE FINDINGS FROM PAPER 1 (MI)

Paper 1 explored what characterized the patient's interpretation of the experienced condition as it was expressed in the communication with the call-taker among patients where a MI was not recognized initially, but after repeated contact, the patients were referred to the hospital (B. Jensen et al., 2023a).

The patients actively sought to interpret their experienced conditions. This was expressed through an awareness of illness in relation to dismissal of possible heart disease caused by lack of well-known symptoms associated with heart disease and previous experiences with disease, not heart related. Elliot mentioned: *"...I hardly dare to say, if it had only been the left arm, then I would immediately be afraid if it was something heart related, but it's not, it is both arms and it hurts like crazy"*. Before contacting the 1813-medical helpline, patients had been coping with the condition by consulting their general practitioner or had been examined at the hospital where no indication of heart disease was detected. Another strategy for handling the condition was self-care in the form of household remedies, over-the-counter drugs, prescription drugs, and guidance from the general practitioner. However, due to

insufficient treatment, the 1813-medical helpline was contacted (B. Jensen et al., 2023a).

Patients felt unsure of the interpretation of the experienced condition, often caused by unclear symptoms leading to frustration and worry. Becca declared: *“I’m not getting anywhere just by talking, I don’t know what it is!”*. Several patients found it difficult to determine the severity of the experienced condition. Edward explained: *“I don’t really know what’s wrong... it seems serious, but I can try taking some painkillers and then wait and see... and if it continues, I will have to call you again”*. When patients could not understand what was going on in their bodies, they explicitly sought out guidance from the call-taker. Bert’s wife asked the call-taker: *“So, I don’t know... what would your advice be?”*. In this way, an acknowledgment of the call-taker’s professional capability was seen. Following uncertainties in interpretations of the experienced condition, patients expressed reluctance in help-seeking because they found it difficult to determine when it would be relevant to call. Elliot stated: *“I was just about to give up on calling you, but then I thought I’d better check it out just as a precaution”* (B. Jensen et al., 2023a).

Several patients entered a negotiation of the interpretation by initiating a discussion of the call-taker’s interpretation of the experienced condition. It was seen in cases where the patient’s understanding of the experienced condition did not correspond to the call-taker’s interpretation. An example of this is Anna, who commented: *“but none of the others have that”* when the call-taker interpreted Anna’s condition as food poisoning. The call-taker, however, did not change the initial interpretation. This illustrates how the patient’s interpretation was overruled by the professional assessment, even though the call-taker did not have access to the patient’s body, cf. figure 4. When patients reported an onset of a new condition that differed from the health care system’s understanding of a severe condition, the chosen response was ‘wait and see’. This was suggested both by call-takers and patients. The call-taker declared to Alex, who reported pain below sternum: *“I think we should just wait and see [...] before we do a whole lot urgently”* (B. Jensen et al., 2023a).

The findings of paper 1 show how patients actively seek to interpret their experienced conditions when communicating with professional call-takers and thereby participate actively in the communicative interaction to assist the call-taker’s decision-making process on choice of response. However, patients are left with a feeling of worry and insecurity when the experienced condition appears unclear from the health system’s perspective (B. Jensen et al., 2023a).

### 3.2.2 SUMMARY OF THE FINDINGS FROM PAPER 2 (MI)

Paper 2 explored characteristics in the call-taker’s decision-making process in the penultimate call before hospital admission (call A) compared to the last call before hospital admission (call B) through communication with patients who had been in contact with the Copenhagen EMS at least twice up to one week before the patient

was diagnosed with MI and where an evolving MI was not recognized at first (B. Jensen et al., 2023b).

Overall, the call-taker's decision-making process was characterized by an interpretation starting out as an unclear symptom picture and dismissal of heart disease in call A to a severe condition, not heart-related, or possible heart disease in call B. An example of this is how the call-taker explained to Laura: *"what makes the difference today is that you have pain in your shoulder... we will come out to you and take a look at what is going on and decide what is the right thing to do"* (B. Jensen et al., 2023b).

The reason for calling in call A was characterized by an equal number of patients reporting sudden onset of a new condition and a condition suffered for several days. In call B, half of the patients reported a deterioration of an existing condition. Other patients called because the recommended treatment in call A was ineffective. The communicative interaction showed how the call-taker's interpretation of the patient's descriptions and with it the decision-making process was structured based on the patient's reason for calling together with the first reported condition by the patient (B. Jensen et al., 2023b).

Across calls, chest pain was a constant element in the communication between patient and call-taker, both through spontaneous utterances by the patient as well as answers to questions asked by the call-taker. The communicative interaction revealed how chest pain did not lead to an interpretation of possible heart disease by the call-taker in call A. The call-taker told Rianna: *"it fits very well with your own diagnosis, that if it was something with the heart, for example, you would feel it around the clock, so to speak ..., After all, you have had this [heartburn] for a few weeks now. It does not indicate that it should be something with the heart"*. In call B, chest pain seemed to be used by the call-taker as a decisive argument in the decision-making about offer of hospital referral. Following Edwards's description of recurrence of chest pain from the day before the call-taker stated: *"then we have to send an ambulance because it can be something with your heart"*. Some patients reported chest pain in both call A and B, other patients only reported chest pain in the call B. When chest pain was reported only in the last call, it was clearly stated as a new symptom leading the call-taker to dispatch an ambulance (B. Jensen et al., 2023b).

Descriptions of chest pain varied across calls, both in relation to the location, how it was expressed, and the duration. An illustration of this is Clara's and Rianna's descriptions. Clara described chest pain in call A as: *"I feel pressure in my stomach and up in my chest, not a weight in the chest, but a pressure"* and Rianna explained in call B when the call-taker asked about chest pain: *"yes and it is killing me ... yes I have chest pressure"*. The descriptions of chest pain in call A were characterized by descriptions that differed from the health system's understanding of chest pain associated with heart disease leading the call-taker to interpret the condition as neither severe nor possible heart disease. This was seen when supplementary questions did not cause the call-taker to suspect heart disease. Although chest pain was used as a

decisive argument in the call-taker's interpretation of the patient's condition and facilitated hospital referral in call B, it was described in various ways (B. Jensen et al., 2023b).

A comparison across calls revealed various negotiations. Negotiations were not in relation to the interpretation of the condition but solely concerning choice of response. In call A, rather than a distinction between heart disease or not, the negotiation of response was based on the distinction between severe/not severe condition as a medical diagnostic selection mechanism. In some cases, the patient argued in favour of treatment in the hospital, however, the call-taker disagreed that the condition was not severe enough to be treated in the hospital or the requested treatment was an obsoleted remedy no longer carried out. Elsa, who suffered earache, wanted her eardrum pricked but the call-taker responded: *"it was done many years ago, but not anymore"*. In other cases, the call-taker offered a hospital referral, but the patient declined. This was seen in Edward's case, who responded when the call-taker offered assessment in the hospital: *"it seems to be severe, but I will try taking the painkillers and then see how it progresses"*. In call B, negotiation of response appeared when the call-taker would let the patient decide on a hospital referral. However, it was only seen in cases of unclear symptoms. The call-taker suggested to Andrew: *"... if you want an assessment in the hospital, you are welcome to do so, but the question is just whether there is so much else they can do"* to which Andrew responded: *"... I would like to just make sure it is nothing else"*. In other cases, although the patient preferred to turn down the hospital referral, the call-taker argued that the best course of action would be assessment in the hospital. This appeared in Riannas case. Even though the call-taker informed her: *"it is because I think it might be something with your heart"*, Rianna responded: *"yes, but they can figure that out here [at home], I do not need to be admitted, do I?"* (B. Jensen et al., 2023b).

### 3.2.3 SUMMARY OF THE FINDINGS FROM PAPER 3 (OHCA)

Paper 3 explored how the call-taker's interpretation of back pain description and decision-making about choice of response was expressed in the communication in calls to the Copenhagen EMS concerning back pain preceding an OHCA. Back pain was explored as an expression of an unclear symptom that both can represent non-severe and severe conditions. Hence, it allowed an exploration of the communicative interaction concerning an unclear symptom (B. Jensen et al., 2022).

A two-part analysis explored both the patient's perspective and the call-taker's perspective. From the patient's perspective, the communication was characterized by patients reporting pain in other parts of the body in addition to back pain. Some patients used the technical term 'lower back pain' when reporting back pain implicitly structuring the communication to focus on symptoms related to the technical term (B. Jensen et al., 2022).

The location of back pain varied between patients and did not lead to a specific choice of response by the call-taker. Furthermore, the back pain was described as

excruciating, oppressive, radiating, or aggravated. In Eric's case, the back pain was described as: *"he can hardly walk or stand or lie down or anything"* and Amy explained the back pain to the call-taker as: *"...some kind of sharp sudden pain, and then it was like a rainy weather inside of me... it just developed insidiously"*. Some patients were awakened by a sudden onset of back pain. Independently of calls being made to the 1813-medical helpline or the emergency number 1-1-2, there was no clear pattern in descriptions of pain and the call-taker's decision-making about choice of response (B. Jensen et al., 2022).

In some cases, the patient explicitly interpreted the conditions as something familiar, which was seen when Frank, who reported shortness of breath, explained: *"I usually feel this way when I suffer pneumonia"*. However, based on detailed questioning the call-taker interpreted the condition as possible heart disease and dispatched an ambulance. In other cases, when the patient reported back pain as the first selection of information and explicitly interpreted the condition, detailed questioning by the call-taker did not indicate a severe condition causing the patients to not being offered treatment in the hospital. While Chris and Alan reported low back pain as the only information, the call-taker asked questions indicating awareness of differential diagnoses. However, the detailed questioning did not lead the call-taker to alter the interpretation of the condition (B. Jensen et al., 2022).

The call-taker's interpretation of the condition led to an implicit confirmation or an explicit disproof of the patient's interpretation, and in cases where the patient did not make an explicit interpretation, the call-taker did, either implicitly or explicitly. This indicated that interpretation of the patient's condition was an important part of the decision-making process regarding choice of response. An explicit disproof of the patient's condition was seen when Amy was concerned about possible heart disease and the call-taker responded: *"because you can provoke the pain physically, we can eliminate that the heart is cause of the pain"*. Independently of calls being made to the 1813-medical helpline or the emergency number 1-1-2, if the patient reported a sudden onset of shortness of breath together with dizziness or chest pain and pain in the upper back, an ambulance was dispatched (B. Jensen et al., 2022).

Chest pain or suspicion of heart disease appeared to be a deciding criterion for the call-taker to dispatch an ambulance. This was illustrated by the following arguments from call-takers: *"male with chest pain"*, *"because I think, it can be the heart you are feeling"* and *"because it could be chest pain"*. Another justification for sending an ambulance was cold sweat and a sudden onset of dizziness together with pain between the shoulder blades (B. Jensen et al., 2022).

For some patients, the reported symptoms did not facilitate further communication by the call-taker. This was seen when the patient uttered several symptoms at once and the call-taker themselves selected specific symptoms for further communication. In other cases, the call-taker asked the patient to choose the most important symptom for further communication. Together this indicated that the patient and call-taker might

have a different understanding of relevant information facilitating decision-making on the choice of response (B. Jensen et al., 2022).

### 3.3 INTEGRATED FINDINGS ACROSS PAPERS

#### 3.3.1 WHICH SERVICE TO CALL

The Copenhagen EMS can be observed as one of the specific communication channels functioning as gatekeeper to healthcare services in hospitals. The primary level in the decision-making process about choice of response is the health system's distinction presence/absence of disease with diagnostics as program. But to determine whether a patient warrants hospital referral, the distinction between severe/not severe condition as a medical diagnostic selection mechanism is applied. From the perspective of the health system, the expectation is that all people who contact the Copenhagen EMS need the service offered by the EMS otherwise they would not contact the Copenhagen EMS, but the question is whether the patient's reported condition is observed as severe or not by the Copenhagen EMS. The structure of the prehospital setting of the Copenhagen EMS with the emergency number 1-1-2 for emergency conditions and the 1813-medical helpline for non-emergency conditions appears to presume that the patient can interpret the experienced condition accordingly (Region Hovedstaden, 2014). By applying the distinction between severe/not severe condition, a secondary code to the health system and the code presence/absence of disease, severe conditions seem to warrant contacting the emergency number 1-1-2. Conditions understood as not severe expressed as a need of guidance or referral to the emergency department seem to warrant contacting the 1813-medical helpline. However, the patient might not be able to interpret the experienced condition according to the distinction between severe/not severe condition making it difficult for the patient to choose which service to call, especially in case of unclear symptom presentation (B. Jensen et al., 2022, 2023a, 2023b). The possibility to forward a call from the 1813-medical helpline to the emergency number 1-1-2, as it was seen in Tom's case (B. Jensen et al., 2023b), is an example of how the Copenhagen EMS tries to compensate for patient's not calling the service equivalent to the call-taker's interpretation of the severity of the condition. It also makes it possible for the system to handle cases with a sudden deterioration of the condition during the telephone consultation. It is also possible for call-takers at the emergency number 1-1-2 to forward a call to the 1813-medical helpline.

Telephone consultations seemed to be structured differently depending on which service was called. As shown in paper 3, call-takers at the emergency number 1-1-2 anticipated an emergency in need of quick-acting decision-making on choice of response reflected in the call-taker initiating the telephone consultation by asking *"What is wrong?"*. Conversely, call-takers at the 1813-medical helpline awaited information from the patient before questions were asked, indicating a less time-dependent decision-making process and a less severe condition. The 1813-medical helpline telephone consultations started with the call-taker inquiring *"What can I do for you?"* or *"What can I help with?"* (B. Jensen et al., 2022). Hence, depending on

which service was called, the call-taker's interpretation of the severity of the reported condition might differ.

From the patient's perspective, it seems as if it could be difficult to determine which service to call, hence, to interpret how severe the experienced condition was, as several patients called the 1813-medical helpline, even though the subsequent MI diagnosis and OHCA provided evidence of a severe potentially fatal condition (B. Jensen et al., 2022, 2023a, 2023b). Although the organisation of the Copenhagen EMS seems to presume that the patients themselves can assess the severity of the experienced condition, it appeared that the patient needed assistance from a health professional to interpret the severity. Thus, from the organisation system's perspective, the patients might not utilize the services of the Copenhagen EMS as intended.

Across all calls, chest pain was seen as an argument for offering a hospital referral indicating a severe condition. Among patients experiencing chest pain, however, no consistency was observed in which service was called, as both the 1813-medical helpline and the emergency number 1-1-2 were contacted by patients reporting chest pain, indicating it could be difficult for patients to interpret the severity of the experienced condition (B. Jensen et al., 2022, 2023a, 2023b).

The complexity of the experienced conditions is further emphasized by the reporting of unclear symptoms which seemed to challenge both the patient's and the call-taker's interpretation of the severity (B. Jensen et al., 2022, 2023a, 2023b). The finding that patients expressed worry and insecurity supports this (B. Jensen et al., 2023a). In addition, some patients expressed uncertainties about when it would be correct to call, emphasizing how difficult it can be for patients to interpret the experienced condition and act accordingly from a health system's perspective, even though the call-takers always assured the patient that calling was the right thing to do. The call-taker, however, did not recognize the severity of the condition as the patients were referred to 'selfcare' or 'watchful waiting' instead of being offered hospital referral (B. Jensen et al., 2023a).

### **3.3.2 FINDINGS, SYMPTOMS, AND DIAGNOSES**

From a health professional perspective, the diagnostic process is a combination of information from the patient as well as a thorough physical examination of the patient (*cf. 1.2 The diagnostic process*). The setting of telephone consultation, however, does not provide the possibility of a thorough physical examination of the patient. Following this, the call-taker may base the medical diagnostic selection mechanism expressed as the decision-making process on choice of response on the patient's selection of information through an interpretation based on the distinction between severe/not severe condition. This approach would assume that the patient can describe the experienced condition adequately to be assisted in the best possible way. The finding that patients found it difficult to describe the experienced condition consistent

with the health system's understanding of severe conditions warranting hospital referral could illustrate this challenge (B. Jensen et al., 2022, 2023a, 2023b).

The diagnostic process seems to be reflected in the structure of the telephone consultations. The aspect of pattern recognition might be reflected in the call-taker's questions about symptoms, both in relation to clarifying questions about symptoms reported by the patient and to identify symptoms not yet mentioned by the patient. The element of patient history could be reflected in the call-taker's questions about previous experiences or family history. Even though the first part of the telephone consultations is characterized by questions concerning pattern recognition, both pattern recognition, and patient history are continuously present during the telephone consultation (B. Jensen et al., 2022, 2023a, 2023b). This indicates how the call-taker must rely on the communicative interaction with the patient and through this on the patient's ability to interpret the experienced condition, as the call-taker does not have access to the patient's body, *cf. figure 4*. Following this, symptoms can be observed as communication about symptoms and not the actual symptom, because neither the patient nor the call-taker has access to the actual symptom. They only have access to their own interpretation of the symptom, *cf. figure 2*.

In addition to the services provided by the Copenhagen EMS, an added function could be observed and understood as assisting the patient to interpret the experienced condition. Even though the patient actively tried to interpret the experienced condition, it appeared to result in a feeling of being worried and insecure when the experienced condition seemed unclear from a health system perspective (B. Jensen et al., 2023a). From the health system's perspective, it seemed that the call-taker failed in assisting the patient's understanding of the condition. Another example would be the patient describing back pain as "*like a rainy weather inside of me*", from a medical diagnostic perspective it did not correspond to a severe symptom that should give rise to offer of hospital referral (B. Jensen et al., 2022). Consequently, the conditions were interpreted as not severe by the call-taker leading to recommendation of 'self-care' and 'watchful waiting' instead of hospital referral, even though the patients were either suffering an evolving MI or OHCA (B. Jensen et al., 2023a, 2023b).

From the call-taker's perspective, the complexity of deciding a response can be illustrated by the willingness to negotiate the response, but not the assessment of the severity (B. Jensen et al., 2023a, 2023b). Unwillingness to negotiate the interpretation of the severity can be seen as an adherence to the rationale of the diagnostic process where the decision-making authority lies with the health professional. The call-taker's instructions to the patients about assurance against misinterpretation is reflected in pattern recognition when the call-taker listed specific symptoms that the patient should react to if they appeared (B. Jensen et al., 2023a, 2023b). In addition, when the call-taker recommended follow-up or postponed the evaluation of the severity, it can be seen as an aspect of the probabilistic approach in the diagnostic process as the call-taker needed more information from the patient before a decision about the severity of the experienced condition could be made (B. Jensen et al., 2023a, 2023b). From a social system theoretically perspective, it can be observed as the call-taker trying to



bind future states of the patient's condition to present decisions (B. Jensen et al., 2023b).

Taken together, it indicates cases where the setting of telephone consultation makes it difficult for the call-taker to interpret the severity based only on the communicative interaction with the patient.

### 3.3.3 THE ROLE OF DECISION SUPPORT TOOLS

The purpose of the Copenhagen EMS is to provide high-quality and efficient resource management in the assessment of patients (Statsrevisorerne, 2017). By controlling the communication, the organisation aims to control which topics the telephone consultations touch on. This can be seen as a way to increase the efficiency in the medical diagnostic selection mechanism reflected in the decision-making on the choice of response. This might be supported by the finding that the majority of all telephone consultations followed a similar structure independently of which conditions the patient described (B. Jensen et al., 2022, 2023a, 2023b).

To assess the severity of the reported condition, call-takers apply decision support tools. From a system theoretical perspective, decision support tools can be seen as a strategy to reduce complexity and function as a program providing criteria for correctness of decisions, in this case, whether the patient should be offered treatment in hospital or not. By applying the distinction between severe/not severe condition, decision support tools can be seen as the organisation's attempt at controlling the communication in the interaction system of telephone consultations based on the rationale in the diagnostic process understood as a medical diagnostic selection mechanism. Because the body and consciousness can be understood as two different autopoietic systems (*cf. figure 2*), the patient's initial selection of information could be observed as being based on an interpretation of physical processes in the body. Then, the call-taker proceeded with the diagnostic process through exploration of pattern recognition by asking questions based on the decision support tool to decide whether a patient fulfil the criteria for hospital referral or not. However, it did not seem to be the condition alone that determined whether it was interpreted as severe or not, it might also depend on the distinction used for observation.

The initial distinction between severe/not severe conditions was made by the patients as the setting of telephone consultations facilitates that the patient must select which service to call. Then, the patient must select a piece of information and utter it to the call-taker at the beginning of the telephone consultation, as mentioned in section 3.3.1 *Which service to call*. The patients, however, employed various approaches in selecting and uttering information to the call-taker at the beginning of the telephone consultations indicating different competences to interpret the experienced condition and subsequently enter a communicative interaction with the call-taker. In addition, several patients described complex conditions even the call-taker had difficulties interpreting leading to patients not being offered hospital referral (B. Jensen et al., 2022, 2023a, 2023b).

The approach to focus on one symptom as a starting point seemed effective in cases with symptom descriptions corresponding to a severe condition based on the health system's understanding, hence, cases with clear pattern recognition. This was reflected in fast decision-making without negotiation of response and decision-making without conditions not facilitating further communication by the call-taker (B. Jensen et al., 2022, 2023b). Conversely, in cases with unclear symptoms or complex conditions, the use of decision support tools seemed to be inhibited when the patient uttered several symptoms at once or described the condition in a way that did not correspond to the rationale of the decision support tools. Assurance against misinterpretation could indicate cases where the medical problem was not well-defined causing the decision support tool to be ineffective in assisting in the medical assessment (B. Jensen et al., 2023b). This appeared to result in dismissal of a severe condition, even though all patients soon after either suffered an OHCA or were diagnosed with MI (B. Jensen et al., 2022, 2023a, 2023b).

### **3.3.4 APPROACHES TO DECISION-MAKING ON THE CHOICE OF RESPONSE**

Call-takers at the Copenhagen EMS seemed to employ different strategies when consulting patients and a decision on choice of response was made (B. Jensen et al., 2022, 2023a, 2023b).

The human skill acquisition developed by Dreyfus & Dreyfus (Bent Flyvbjerg, 2000; Dreyfus & Dreyfus, 1986) defines five steps from novice to expert, which illustrates how the novice is characterized by context-independent elements and rules as a foundation for action. The expert uses an intuitive, holistic, and synchronous approach in decision-making based on experience and critical reflections. The first three steps in the learning process are defined by analytical problem-solving where decisions are made based on rules, principles, and universal solutions. Following this, individuals cannot solely reach levels four and five characterized by intuition and know-how, by applying an analytical approach to decision-making (Bent Flyvbjerg, 2000; Dreyfus & Dreyfus, 1986).

Overall, the medical diagnostic selection mechanism reflected in the decision-making process in the telephone consultations seemed to follow a similar structure characterized by an analytical problem-solving approach based on context-independent rules and principles in the majority of the calls, likely due to application of the decision support tools. The call-taker's interpretation of chest pain in the penultimate call among patients suffering MI can be seen as an example of decision-making on the choice of response based on context-independent rules and principles without an intuitive approach based on critical reflections. Thus, the argument for the chosen response was that the chest pain was not described following the health system's understanding of chest pain associated with heart disease (B. Jensen et al., 2023b). Moreover, the finding of no clear pattern between descriptions of back pain among patients describing back pain preceding OHCA and the call-taker's decision-making on choice of response could indicate the use of an analytical problem-solving

approach among call-takers not offering hospital referral compared to an intuitive and holistic approach based on critical reflections and experience among call-takers offering hospital referral (B. Jensen et al., 2022).

By applying the concept of novice vs expert, two different approaches to the call-taker's interpretation of the experienced condition can be observed in the case of Alex and Andrew, both talking with a physician. Alex and Andrew were reporting similar conditions, Alex described pain below the sternum and Andrew described heartburn, in both cases interpreted as acidity by the call-takers leading to the recommendation of antacid consumption in call A (B. Jensen et al., 2023a, 2023b). However, both contacted the 1813-medical helpline again because the recommended treatment was ineffective leading to two different interpretations, thus decision-making on the choice of response. In Andrew's case, the call-taker maintained the interpretation of acidity: *"It is probably a severe case of acidity, but Lansoprazole [acidity medication] has little effect within one hour"*<sup>6</sup>. In Alex's case, the call-taker argued that: *"unexplained abdominal pain not responding to routine treatment, we must have him assessed in the hospital ... it has nothing to do with his stomach. We will stop thinking of that ..."* (B. Jensen et al., 2023b). In Andrew's case, the call-taker's interpretation of the experienced condition can be seen as an analytical approach to decision-making because the call-taker did not evade the context-independent rules and principles except when letting Andrew decide whether he wanted to go to the hospital. Conversely, in Alex's case, the interpretation seemed to be an intuitive approach based on critical reflections. Further emphasized by context-dependent reasoning by the call-taker: *"...when you have it [unexplained abdominal pain] in a man his age, then you have to think about whether there is something behind it and that is why I am sending an ambulance"*. Conversely, in cases with symptom descriptions consistent with the medical understanding of symptoms associated with possible heart disease, the call-taker followed the logic in the decision support tool and dispatched an ambulance. This was especially seen among patients reporting chest pain as a new symptom or chest pain in combination with other symptoms associated with possible heart disease (B. Jensen et al., 2022, 2023b).

Decision support tools can be seen as an example of an analytical problem-solving approach based on context-independent rules and principles. An analytical problem-solving approach appeared to be efficient when handling well-defined problems with well-established solutions but less efficient when dealing with problems less defined. Patients with severe conditions such as an evolving MI or OHCA not referred to the hospital indicate that there are cases where the analytical problem-solving approach reflected in the decision support tools seemed incapable of assisting the call-taker to make a correct assessment of the reported condition (B. Jensen et al., 2022, 2023a, 2023b).

When nurses are required to use the decision support tools and physicians apply them to a considerable extent it could inhibit the call-takers' use of an intuitive approach

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<sup>6</sup> Citation not included in paper 2.

based on experience and critical reflection as understood by Dreyfus & Dreyfus (Dreyfus & Dreyfus, 1986). When Oliver's wife called the 1813-medical helpline because Oliver was having intense pain around the solar plexus and heartburn together with radiating pain to the right arm leading the call-taker (a nurse) to argue "... *he could experience something we call atypical heart pain, and I cannot eliminate that*"<sup>7</sup>, it could indicate that the call-taker applied an expert approach based on experience and critical reflection. Similarly, when the call-taker (a physician) explained to Mike, known with myalgia in the back and the chest, that the pain he experienced was a side-effect of his prescription medicine, it seems that the call-taker did not apply the decision support tool in the assessment but rather used clinical experience. Even though the call-taker seemed to base the assessment of Mike's condition on clinical experience, an evolving MI was not recognized by the call-taker (B. Jensen et al., 2023a).

### **3.3.5 RISK/DANGER DISTINCTION – OBSERVING THE DECISION-MAKING PROCESS**

By applying a second-order observation with the risk/danger distinction (Baraldi et al., 2021; Luhmann, 2002a), it may be possible to analyse how decision-making in telephone consultations works, both from the patient's and call-taker's perspectives.

As described in section 2.2.2 *Types of social systems*, the concept of risk refers to how consequences of decisions made in the present affect the possibility of future damage, and danger is understood as possible damage attributed to the affected party caused by the decision (Baraldi et al., 2021; Luhmann, 2002a, 2012). Depending on the focus of analysis, the decision-maker and the affected party can both be the patient as well as the call-taker being the decision-maker and the patient being the affected party.

From the patient's perspective, a decision to call the Copenhagen EMS is made because the patient experiences a condition in the body, they need assistance from the health system to handle (B. Jensen et al., 2022, 2023a, 2023b). The risk of future damage is not in reacting to the experienced conditions in the body causing a danger of an evolving MI or OHCA not being treated as patients included in this PhD study was subsequently either diagnosed with MI or suffering an OHCA. Still, several patients were not offered hospital referral as the call-takers decided not to offer treatment in hospital caused by an interpretation of the patients' conditions as not severe based on the medical diagnostic selection mechanism reflected in the communicative interaction in the telephone consultations (B. Jensen et al., 2022, 2023a, 2023b).

The call-taker's decision-making process can also be understood based on the distinction between risk and danger linked to pattern recognition. While the Copenhagen EMS is observed as an organisation system with the function of decision-

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<sup>7</sup> Citation not included in paper 1.

making on behalf of the healthcare system, the code severe/not severe condition is applied. Based on the code severe/not severe condition, the call-taker decides whether the patient is included in the health system's services by being offered a hospital referral or is excluded by being referred to 'self-care' or 'watchful waiting'. Possible future damage of a decision made in the present telephone consultation is that the call-taker misinterprets the patient's reported condition as not being severe warranting hospital referral, thus posing a danger to the patient of not being treated according to guidelines and in the worst case are in danger of dying. This is the case for all patients later diagnosed with MI not offered hospital in the penultimate call (B. Jensen et al., 2023a, 2023b) and the six patients suffering an OHCA, not offered hospital referral (B. Jensen et al., 2022).

With the invention of the healthcare system and in the case of the PhD study more specifically the prehospital setting, the danger of suffering a MI or an OHCA has transformed into the danger of not being treated if a call-taker decides not to offer hospital referral by dispatching an ambulance. The patient might be in danger of dying because the call-taker decides not to offer hospital referral by dispatching an ambulance (B. Jensen et al., 2022, 2023a). In this case, the health system might apply a danger to the patient when the call-taker decides not to send an ambulance.

From a system theoretical perspective, assurance against misinterpretation could be seen as the result of the risk/danger distinction where the described conditions were difficult to interpret, from the call-taker's perspective, because the described conditions did not correspond to the health system's understanding of severe conditions warranting hospital referral. Assurance against misinterpretation could also be understood as system maintenance, a strategy to secure continuing existence (Luhmann, 1995), when the call-taker advises recommended follow-up. Negotiation of response, assurance against misinterpretation, and postponement of evaluation of severity could be seen as aspects of complementary functional equivalents because they are all approaches to the decision-making about choice of response, applied by the call-taker, when the decision support tool appeared ineffective in assisting the decision-making process (B. Jensen et al., 2022, 2023a).

The risk/danger distinction makes it possible to mark both sides of the distinction, but not simultaneously (Luhmann, 2002a). In cases with well-defined medical problems interpreted as severe by the call-taker, the decision to dispatch an ambulance is likely to indicate cases where the call-taker marked the danger. Conversely, in cases with unclear symptoms, the call-taker seemed more inclined to mark the risk. Findings indicate that the call-takers were inclined to interpret unclear symptoms as not severe (B. Jensen et al., 2022, 2023a, 2023b). Following this, risk would be marked by the call-taker as the patient's experienced condition did not appear to indicate possible future damage, from the call-taker's perspective. Hence, negotiation of response was observed when the call-taker marked the risk and thereby allowed dangers to be forgotten by arguing that the experienced condition warranted 'self-care' or 'watchful waiting' but in the same telephone consultation, the patient marked the danger, hence, focusing on the danger of a severe condition warranting hospital referral. This could

explain how the negotiation of response was present in all three papers (B. Jensen et al., 2022, 2023a, 2023b). Furthermore, it could also explain why negotiation in relation to patients wanting to go to the hospital, but call-takers rejecting was only seen in calls with patients not offered a hospital referral (B. Jensen et al., 2022, 2023b). Conversely, in other cases, the patient emphasized the risk by expressing reluctance in going to the hospital, even though the call-taker argued the danger of possible heart disease (B. Jensen et al., 2023b). Following this, each participant in the interactive communication marked the other side of the same distinction, and negotiation could be observed in the communication. As the call-taker represents an organisation with the function of deciding if a patient is to gain access to the services of the health care system by offering a hospital referral or not reflected in a medical diagnostic selection mechanism, the decision-making capacity lies with the call-taker and explains why it was not possible for the patients to overrule the call-taker's assessment of the severity (B. Jensen et al., 2022, 2023a, 2023b).



## **CHAPTER 4. DISCUSSION**

This chapter first presents a discussion of the integrated findings across the material. The findings are discussed in relation to the overall aim of the PhD study. Secondly, strengths and limitations in relation to the applied methodology are discussed.

### **4.1 DISCUSSION OF FINDINGS**

In this section, the integrated findings across papers are discussed drawing on the social system theoretical framework and in the context of existing research.

The overall objective of this PhD study was to understand reaction to early warning signs of MI and OHCA by exploring how patients observe, describe, understand, and interpret conditions expressed in telephone consultations preceding suffering a MI and OHCA. Furthermore, to understand how call-takers react to the patients' experienced condition by exploring the decision-making process on choice of response. Through the next sections, the influence of the communicative interaction on the reaction to early warning signs of MI and OHCA will be discussed drawing on social systems theory's understanding of function systems, organisation systems, and interaction systems.

#### **4.1.1 FUNCTION SYSTEM PERSPECTIVE**

Given the understanding of the present society as functionally differentiated, the health system plays a key role in the function of the prehospital setting, including the Copenhagen EMS, through the application of the code presence/absence of disease. However, in the prehospital setting other functionally differentiated distinctions are also applied.

The economic system and the political system are structurally coupled to the Copenhagen EMS, as the political system in particular allocates financial resources that influence the delivery of health services. The structural coupling of the economic system is present as it is policymakers on a national level, who allocate general grants to the health services in the five regions in Denmark through the state budget. Furthermore, through political discussions on regional level response time for ambulances is stipulated (Indenrigs- og Sundhedsministeriet, 2016). According to the economic system, every healthcare service is priced, hence shorter response time costs more. Moreover, treatments in hospitals are also an economic calculation. While the Copenhagen EMS is a part of the publicly funded healthcare system in Denmark, policy considerations and objectives concerning healthcare services are negotiated on a national level by policymakers. Then the function of the regional politicians is to transform national-level policy decisions into healthcare services for the public. In the event of unlimited resources in society, all patients who contact the Copenhagen EMS would be offered hospital referral. However, there are limited resources and to prioritize the available resources the code severe/not severe condition is applied when



a medical problem is assessed in the telephone consultations. This does not mean that the decision on severe/not severe condition is directly observed as an expression of an economically based decision, but that to the extent that there were more financial means available, one could imagine that the room for action for the Copenhagen EMS would be larger.

Furthermore, the scientific system and the health system are structurally coupled through research identifying conditions and treatments warranting admission to a hospital. Medical priorities are determined by the National Board of Health, which advises the policymakers (Sundhedsstyrelsen, 2023). Lastly, several aspects of a hospital are regulated from a legal point of view for example patient rights through the standardized hearing of patient or treatment complaints and violation of patient rights (Patientklagenævnet, 2023).

The concept of polycontextuality reflects the understanding that it is always possible to observe a specific situation in another way based on another communicative code with different programs for distinction (Kneer et al., 1997; Knudsen & Vogd, 2015). Polycontextuality offers an understanding of how the healthcare system as an organisation, including the prehospital setting of Copenhagen EMS, can be observed as a polycontextual organisation where decision-making on choice of response is not exclusively based on but must be justifiable from a medical point of view i.e., the medical code presence/absence of disease reflected in the medical diagnostic selection mechanism. Decisions on choice of response are also observed by applying different codes for example the economic code, the political code, or the scientific code.

## **4.1.2 ORGANISATIONAL PERSPECTIVE**

As the prehospital setting of telephone triage at the Copenhagen EMS can be understood as an interaction system on behalf of an organisation system, the Copenhagen EMS function as one of the gatekeepers to the services of the healthcare system.

### **4.1.2.1 Navigating entrances to the services of the healthcare system**

The specific horizon of expectation related to each service at the Copenhagen EMS is constructed by the system and therefore presumes that the patient can interpret their experienced condition following this distinction. The rationale of the organisation of the prehospital setting seems to imply that patients can interpret the experienced condition and contact the service equivalent to the severity. As described in the introduction, the prehospital setting together with the general practitioner function as gatekeeper to the services of the healthcare system. From a system theoretical perspective (Baraldi et al., 2021; Luhmann, 2013), Copenhagen EMS can be understood as an interaction system set up by the healthcare system with the function of reducing complexity regarding which diseases must be included in the system. Copenhagen EMS as an interaction system is thus under the influence of decisions made in the healthcare system, specifically decisions regarding diagnostic criteria for

inclusion. Hence, Copenhagen EMS functions as an inclusion and exclusion mechanism. From the patient's perspective, however, the particular communication channels may seem to increase the complexity as it is up to the patient to choose which service to contact. The present study indicates that it can be difficult for patients to choose the service corresponding to the severity of the experienced condition (B. Jensen et al., 2022, 2023a, 2023b). Several patients suffering an OHCA and the majority of patients subsequently diagnosed with MI contacted the non-emergency 1813-medical helpline indicating an interpretation of the experienced condition as not severe by the patients (B. Jensen et al., 2022, 2023a, 2023b). Along these lines, Birnbach et al. (Birnbach et al., 2020) found less than half of the patients suffering from acute coronary syndrome were able to attribute experienced conditions to possible heart disease. Previous literature documents how it can be difficult for patients to choose the correct first contact (Ångerud et al., 2019; Pattenden et al., 2002; Thylén et al., 2015). System theoretically, calls to a service not corresponding to the severity of the condition can be understood as continual irritation by the environment (Luhmann, 2012). From the system's perspective, an approach to respond to the continual irritation is to apply strategies to minimize the continual irritation in order to reduce complexity not only within the system but also from the patient's perspective. Educating the public to choose the correct particular communication channel is one approach applied by the healthcare system to handle this irritation from the environment. An example is the information campaign "Call Correct" [Ring Rigtigt] made by the prehospital setting in the North Denmark Region (Region Nordjylland, 2018). The campaign consists of posters guiding how the severity of a medical problem is to be evaluated ending with instructions to call either the general practitioner, the general practitioner cooperative, or the emergency number 1-1-2 (Region Nordjylland, 2018). The Capital Region of Denmark has a similar campaign (Region Hovedstaden, 2014). The campaigns could indicate that making the patient choosing a prehospital service equivalent to the severity of a medical problem is a challenge in Denmark, in general. The finding that there seems to be no consensus among symptom combinations and whether the 1813-medical helpline or the emergency number 1-1-2 was contacted supports this (B. Jensen et al., 2022, 2023a, 2023b).

The concept of horizon of expectations refers to the expectation of possible behaviour in a given situation (Luhmann, 1995), and may explain how the call-taker at the 1813-medical helpline and the emergency number 1-1-2 could have different expectations to the severity of the patient's conditions. Given the main function of the 1813-medical helpline is to handle non-emergency conditions (Lindskou et al., 2019; Zinger et al., 2022), the horizon of expectations would not be a severe potentially fatal condition. Conversely, the function of the emergency number 1-1-2 is to handle emergency conditions most likely warranting dispatch of ambulances (Zinger et al., 2022). Findings suggest that the patients might find it difficult to assess the severity of the experienced condition, hence, need professional assistance to interpret the experienced condition. No clear pattern between symptom descriptions and service contacted indicates that it might be difficult for the patient to interpret the severity of the experienced condition (B. Jensen et al., 2022, 2023a, 2023b). The difficulties in

interpreting the experienced condition regarding when and which service to contact was acknowledged by the call-takers in situations where the patient expressed uncertainties regarding this issue (B. Jensen et al., 2023a, 2023b).

System maintenance is an approach applied by the system to manage irritations from the environment (Luhmann, 1995). Triage levels at the 1813-medical helpline ranging from dispatch of ambulance to ‘contact your general practitioner’, ‘watchful waiting’, and ‘self-care’ can be understood as a strategy for system maintenance as it might be a way to compensate for patients not choosing the correct particular communication channel, from the healthcare system’s perspective. Consequently, the complexity within the system increases which may make it more difficult for the system (call-taker) to decide on a response. From the patient’s perspective, the 1813-medical helpline could be seen as a service to reduce the complexity of the experienced condition, as the decision on choice on response allows non-emergency conditions as well as severe conditions warranting dispatch of ambulances. In this way, the interpretation of the severity of experienced condition could be understood as being transferred from the patient to the system. This might explain why the majority of patients in the PhD study chose to contact the 1813-medical helpline, even though all the patients were either subsequently diagnosed with MI or suffered an OHCA (B. Jensen et al., 2022, 2023a, 2023b).

#### **4.1.2.2 Dilemmas in utilization of decision support tools**

Decision support tools are an integrated part of telephone triage (Anderson & Roland, 2015; Deakin et al., 2017; Kaminsky et al., 2017; Murdoch et al., 2015; Smits, Keizer, et al., 2017; Zinger et al., 2022). System theoretically (Luhmann, 2002a, 2012), decision support tools can be described as a technology. The overall definition of technology is to transform input from the environment to more or less specific output within the system (Luhmann, 2002a, 2012). In this way, technology is attached to the organisation to control how the interaction between patient and call-taker is to be conducted to decide on choice of response reflected in the medical diagnostic selection mechanism. By applying decision support tools in the telephone triage, the patients’ descriptions of experienced conditions are transformed into conditions corresponding to the program providing criteria for correctness of decision i.e., the distinction between severe/not severe conditions. From an organisational perspective, decision support tools have two functions: one is to contribute to systematic triage based on updated professional medical knowledge and thereby facilitate fast and effective decision-making on choice of response and another is to provide legal backing to call-takers (Vinge & Rasmussen, 2018). In line with previous studies (Ericsson et al., 2019; Gamst-Jensen et al., 2017; Lindström et al., 2014; Wouters et al., 2020), findings indicate that severe conditions consistent with the rationale of the decision support tools are triaged accordingly (B. Jensen et al., 2022, 2023a, 2023b). However, a limitation occurs when patients’ experienced conditions are not reflected in the decision support tools. Following this, findings showed that unclear symptoms and complex conditions not reflected in the decision support tools might lead to a lack of recognition of a severe condition warranting hospital referral (B. Jensen et al., 2022,

2023a, 2023b). The abovementioned limitation poses a challenge to the individual call-taker, who must decide on a response despite the lack of assistance from the decision support tool. To compensate for this limitation, call-takers were found to apply different approaches in the decision-making on choice of response, i.e., negotiation of response, assurance against misinterpretation, postponement of the evaluation of the severity, and recommended follow-up (B. Jensen et al., 2022, 2023a, 2023b). As decision support tools can be understood as a way for the organisation to control the interactive communication between patients and call-takers, it seems that the organisation does not recognize the described limitation. Therefore, the problem remains within the interaction systems and continues to be handled only at the interactional level thus no feedback seems to be conveyed back to the organisational level. Hence, there seems to be a potential for learning by introducing feedback from the call-takers to the organisation and thereby facilitating reflection on potential revisions of the decision support tools. The described limitation could explain why call-takers apply different approaches to handle unclear symptoms and complex conditions in the decision-making process on choice of response and might explain why Alex's and Andrew's apparent similar conditions resulted in different choices of response by the call-takers (*c.f. 3.3.4 Approaches to decision-making about choice of response*).

Divergence between the rationale of the decision support tool and the patient's presenting problems might lead to dilemmas in the decision-making process on choice of response (Ek & Svedlund, 2015; Murdoch et al., 2015; Wouters et al., 2020). Findings suggest that in cases with complex or unclear conditions decision support tools might not provide sufficient guidance in interpreting the severity of the condition. As a result, postponement of the evaluation of the severity was seen or assurance against misinterpretations in the form of recommended follow-up or listing symptoms the patient should react on (B. Jensen et al., 2022, 2023a, 2023b). Along these lines research has shown that call-takers may overrule the decision support tools if assessment of the urgency based on the decision support tools does not correspond the health professional's subjective assessment (Wouters et al., 2020). Findings indicate that negotiating the response was particular predominant in case of unclear conditions as it appeared to be difficult to interpret the severity of the experienced condition, both from the patient's perspective and the call-taker's perspective, and decision support tools did not seem to assist (B. Jensen et al., 2022, 2023a, 2023b).

The human skill acquisition developed by Dreyfus & Dreyfus (Dreyfus & Dreyfus, 1986) offers an understanding of triage based on decision support tools as a novice approach with a focus on context-independent elements and rules. As mentioned in section 2.3 *Study setting*, call-takers at the Copenhagen EMS apply the decision support tool as an integrated part of the decision-making on choice of response. This could explain why less experienced call-takers might find decision support tools helpful (I. K. Holmström et al., 2019, 2020; Mebrahtu et al., 2021). Conversely, in cases with complex or unclear conditions, the significance of the call-taker's skills might be reflected in the expert level, as described by Dreyfus & Dreyfus (Dreyfus & Dreyfus, 1986). Given the function of the decision supports tools is to ensure high-

quality and efficient resource management in the assessment of patients' reported medical problems (Statsrevisorerne, 2017), patients with unclear or complex conditions appear to be less likely assisted by the decision support tools, hence more depended upon the call-taker's professional skills. Moreover, previous studies indicate that call-takers seem to apply professional and personal resources to a greater extent when handling difficult calls (I. K. Holmström et al., 2021; Yliluoma & Palonen, 2020).

Another limitation connected to the use of decision support tools is that they may fail to incorporate the patient's perspective (Gamst-Jensen et al., 2018). Along these lines, it has been argued that the patient's expression of the degree-of-worry might be associated with imminent hospitalisation (A. N. Jensen et al., 2021). The finding that call-takers when confronted with unclear or complex conditions might enter a negotiation of the chosen response and not the assessment of the severity offers an understanding of how the call-taker may partly include the patient's perspective. However, only regarding a discussion of response and not in relation to the interpretation of severity (B. Jensen et al., 2022, 2023a, 2023b). In line with previous studies (Gamst-Jensen et al., 2018; Stolper et al., 2022), findings indicate that incorporating the patient's perspective in the interpretation of the severity, severe conditions warranting hospital referral might be identified sooner (B. Jensen et al., 2022, 2023a, 2023b). However, Watkins et al (Watkins et al., 2021) argue that adding further items to the decision support tools might impact diagnostic accuracy negatively.

Murdoch et al. (Murdoch et al., 2015) have argued that the function of decision support tools can be understood as founded in a positivist philosophy with an understanding of a linear correlation between the rationale of the decision support tool and the patient's experienced conditions. Findings suggest cases with a lack of equivalence between patient's experiences and the call-taker's interpretation of the severity of the condition based on the decision support tools as several patients were diagnosed with MI or suffered an OHCA, even though the condition was interpreted as not severe (B. Jensen et al., 2022, 2023a, 2023b). Constructivism as a philosophy of science reflected in social systems theory offers an understanding of a human being as an interplay between three separate autopoietic systems (*cf. figure 2*). Following this understanding, neither the patient nor the call-taker has direct access to the conditions in the patient's body only an interpretation of the experienced condition is available (*cf. figure 4*). Processes in the body can disturb the consciousness, especially expressed as pain. From the perspective of the mind, the function of pain can be understood as reducing the complexity in the body's condition as pain focuses the attention on the body (Luhmann, 1993). The finding that patients used various descriptions when uttering the experience of for example chest pain and back pain offers an understanding of how conditions in the body are interpreted by the consciousness and not merely is an expression of the reality as such/on its own. Thus, conditions expressed differently than the rationale of the decision support tool might be at risk of not being interpreted as severe. Given the epistemological constructivist understanding of conditions, the PhD study illustrates how the role of the

communicative interaction between patient and call-taker on the behalf of the organisation system is likely to play a decisive role in the correct interpretation of the experienced condition (B. Jensen et al., 2022, 2023a, 2023b).

### **4.1.3 INTERACTIONAL PERSPECTIVE**

From an interactional perspective, the aforementioned factors seemed to affect the communicative interaction between patients and call-takers and thus the decision-making on choice of response.

#### **4.1.3.1 Making complexity available**

When a call is being made to the Copenhagen EMS, the organisation, as a social system, is coupled structurally to the patient by making the system's complexity available in the form of healthcare knowledge and knowledge on diagnoses to the patient. Similarly, the patient, as a psychic system, makes their complexity available to the call-taker at the Copenhagen EMS. The complexity made available by the patient can be understood from a layman perspective, which might not communicate about symptoms in accordance with the health professional understanding. Each psychic system may interpret bodily symptoms differently and as patients, they may be novices.

As illustrated in figure 2, a human being can be understood as an interplay between three autopoietic systems (body/mind/person) which are structurally coupled. In the context of the PhD study, the human being presents themselves as a potential patient, one who might be ill, thus, require treatment. Based on this understanding, the psychic system makes an interpretation of the condition in the body and by calling the Copenhagen EMS enters an interaction system with a call-taker. The understanding of patients and call-takers being separate autopoietic psychic systems with separate meaning-constituting operations could explain why it can be difficult for a patient to interpret and describe a condition in the body, which might even be a new experience to the patient. It might offer an understanding of why an often-used strategy by patients was to refer to previous or lack of previous experiences when trying to interpret the experienced condition (B. Jensen et al., 2022, 2023a, 2023b). Furthermore, it could also explain why patients and call-takers not necessarily used identical language to describe and interpret the experienced condition. Along these lines, it could also explain why the severity of back pain could be misinterpreted when the patient inaccurately used technical language to describe the experienced condition. On the one hand, it might result in effective communication with the call-taker and seemed to facilitate a quick decision-making process on choice of response. On the other hand, it seemed to increase the risk of misinterpretation of the severity of the condition, which was seen among both patients suffering MI and OHCA (B. Jensen et al., 2022, 2023a, 2023b). Existing research also documents how inaccurate use of technical language might lead to the misidentification of a severe condition (Richards et al., 2022).

The findings illustrate how the first selection of information by the patient is the starting point of the interpretation of severity (B. Jensen et al., 2022, 2023a, 2023b). The understanding of communication as a synthesis of three selections (*cf. figure 3*) complies with this approach. When a patient uttered information about several different symptoms at the same time, which can be understood as making a high level of complexity available to the call-taker's interpretation of the condition, the call-taker reacted by asking the patient to choose which symptom was most important for further communication (B. Jensen et al., 2022). From the call-taker's perspective, it may be understood as an approach to reduce the complexity in order to carry out the function of deciding on choice of response and might indicate a presumption by the health care system that the patient is capable of making that interpretation. From the patient's perspective, however, the patient's initial utterance of several symptoms simultaneously indicates that the patient might not be capable of making that choice because they might not have the required knowledge to make such a decision, hence it doesn't make sense for the patient to make such a choice. At the same time, letting the patient decide on a symptom for further communication can be seen as the call-taker's acknowledgment of the complexity of the patient's condition, even though the approach chosen by the call-taker did not facilitate faster recognition of a severe condition (B. Jensen et al., 2022). With the call-taker's function of deciding on a response equivalent to the severity of the condition in mind, the approach to request the patient to choose a symptom for further communication seemed ineffective causing danger of future damage to the patient.

While interaction systems are characterised by a clear definition of role assignments (*cf. 2.2.2 Types of social systems*), the call-taker's approach of letting the patient decide on a symptom for further communication opposes the clear definition of role assignments. A complex condition with unclear symptoms is likely to explain the call-taker's approach, however, it might result in an increased level of complexity as the patient seemed to find it difficult to choose, which information was most important to reflect the severity of the experienced condition. In addition, negotiation of response indicates cases with no clear definition of role assignments. On the one hand, when interpreting the severity of the patient's condition the call-taker maintained the assigned role. On the other hand, when the call-taker participated in a negotiation of response, it indicates a decomposition of role assignments (B. Jensen et al., 2022, 2023a, 2023b).

#### **4.1.3.2 Telephone triage – factors affecting the interpretation of the severity**

In a setting without face-to-face interaction and the possibility of a thorough physical examination of the patient, the communicative interaction between the patient and call-taker becomes an essential factor in the interpretation of the severity of the condition reflected in a medical diagnostic selection mechanism and subsequent decision-making on choice of response. Even if call-takers working with telephone triage are aware of this precondition, findings indicate cases beset by challenges in the interpretation of the severity, especially complex conditions or unclear symptoms

seemed to pose a challenge reflected in the lack of recognition of a severe condition warranting hospital referral (B. Jensen et al., 2022, 2023a, 2023b). Previous studies document how the risk of misinterpretation of the severity might depend on both the patient's ability to describe the experienced condition and the call-taker's ability to interpret the severity (Gamst-Jensen et al., 2017; I. Holmström & Höglund, 2007; Lindström et al., 2014; Richards et al., 2022; Yliluoma & Palonen, 2020). Video consultations might provide a supplement to telephone triage, however, it may still be difficult to conduct a physical examination of the patient (Thiyagarajan et al., 2020). In relation to recognition of early signs of MI and IHCA, video consultations would likely to a great extent still depend upon the communicative interaction. As prodromal symptoms as such are not visible, the interpretation of the severity would likely still rely on how the condition is described and uttered by the patient. From the call-taker's perspective, however, video consultations might assist in the selection of understanding, as video consultations address more aspects of the non-verbal communication, for example, cold sweat or being pale. Both conditions the call-taker explicitly asks about to interpret the severity of the patient's experienced condition but might be difficult for the patient to describe (B. Jensen et al., 2022, 2023a, 2023b)

Communicative techniques may be an important supplement to decision support tools in the interpretation of the severity and open-ended questions are found to provide more medical-rich descriptions and more information (Ernesäter et al., 2014, 2015). Even though findings indicate that assessment of the severity at the 1813-medical helpline may apply open-ended questions and handles spontaneous utterances to a greater extent than the emergency number 1-1-2 (B. Jensen et al., 2022), it did not facilitate faster recognition of severe conditions warranting hospital referral (B. Jensen et al., 2022, 2023a, 2023b).

From the call-taker's perspective, lack of visual contact is likely to introduce challenges to the interpretation of the severity. The call-taker may relay the assessment of the severity on non-verbal utterances (Pettinari & Jessopp, 2001; Wouters et al., 2020). Findings suggest a similar approach was seen when call-takers asked about breathing problems or pain impact (B. Jensen et al., 2022, 2023a, 2023b). Along these lines, shortness of breath may be more prevalent among patients suffering an OCHA than previous documented (Gnesin et al., 2022; Watkins et al., 2021; Wibring et al., 2019).

Findings illustrated strategies to handle complex symptom descriptions where the interpretation of the severity proved to be difficult. Strategies included: assurance against misinterpretation, negotiation of response, recommended follow-up, and postponement of evaluation of the severity (B. Jensen et al., 2022, 2023a, 2023b). Social system theory offers an understanding of these strategies as a way for the system to respond to the risk of misinterpreting the severity in the present, thus affecting the possibility of the patient not being offered treatment equivalent the severity of the condition, understood as future damage. Even though the strategies may reduce the complexity in the interpretation of the severity and facilitate the decision-making process on choice of response, they did not appear to result in faster



recognition of severe conditions warranting offer of hospital referral (B. Jensen et al., 2022, 2023a, 2023b).

In some cases, the patients called the Copenhagen EMS again due to recommended follow-up suggested by the call-taker in the previous call. Some of the patients, however, continued the previous conversation as if there was no time between the calls (B. Jensen et al., 2023b). From a social system theoretical perspective, interaction systems dissolve when the interaction is completed, *cf.* 2.2.2 *Types of social systems*. Hence, the patient cannot couple up to the same interaction system established in the previous call, because it dissolved when the telephone consultation ended. Moreover, as telephone consultations function as interaction systems on behalf of an organisation through structural coupling, the patient couples up to an organisation system and not an interaction system. From the patient's perspective, the structural coupling between telephone consultations at the Copenhagen EMS and the healthcare system might lead to confusion as to how much information from the previous telephone consultation is available to the call-taker in the current telephone consultation (B. Jensen et al., 2023b). Consequently, the patient must actualize the information once more in the current telephone consultation. This could indicate that patients might find it difficult to navigate the set-up of the prehospital telephone consultations.

#### **4.1.3.3 Symptom descriptions – factors affecting the interpretation of the severity**

Findings indicate that symptom descriptions were used as justification in the call-taker's decision-making on choice of response (B. Jensen et al., 2022, 2023a, 2023b). System theoretically, telephone triage is understood as a diagnostic selection mechanism that assesses the severity of the reported medical problem by distinguishing between severe/not severe condition, and thus who is included and excluded. Several elements of the diagnostic process as described by Wulff & Gøtzsche (Wulff & Gøtzsche, 2001) can be seen in telephone triage. Findings illustrate how pattern recognition based on a probabilistic approach is present in the telephone consultations (B. Jensen et al., 2022, 2023a, 2023b). Reporting unclear symptoms or combination of symptoms not consistent with the health system's program for diagnostics was found to have an impact on the interpretation of the severity by the call-taker causing an interpretation of the condition as not severe, even though the patients were either diagnosed with MI or suffered an OHCA soon after (B. Jensen et al., 2022, 2023a, 2023b). This is consistent with research on how unclear symptoms descriptions or lack of structure in the communicative interaction seem to affect the identification of severe conditions negatively and might prolong the decision-making on choice of response (Alfsen et al., 2015; Ericsson et al., 2019; Gamst-Jensen et al., 2017; Lindström et al., 2014; Richards et al., 2022; van Rensburg et al., 2021; Wibring et al., 2019; Yliluoma & Palonen, 2020). In line with previous studies (Ericsson et al., 2019; Lindström et al., 2014), findings suggest that symptom descriptions in accordance with the medical literature facilitate fast and effective

recognition of severe conditions warranting offer of hospital referral (B. Jensen et al., 2022, 2023a, 2023b).

Awareness of possible heart disease was a constant element in the interpretation of the severity across patient groups (B. Jensen et al., 2022, 2023a, 2023b), indicating consistency with the consideration of the possibility of rare but severe potentially fatal conditions in the diagnostic process (Wulff & Götzsche, 2001). The patients in the PhD study, however, seem to illustrate cases being exceptions to recognizing a severe condition using a probabilistic approach as several call-takers explicitly dismissed possible heart disease based on symptom descriptions. Unclear symptoms and descriptions of symptoms not corresponding to the medical understanding of prodromal symptoms associated with MI and OHCA seemed to hinder recognition of a severe condition (B. Jensen et al., 2022, 2023a, 2023b). Selection of information, the first selection in the three-part synthesis of communication (*cf. figure 3*), may be reflected in the key element of choosing one symptom as a starting point in the diagnostic process based on the professional knowledge of diseases (Wulff & Götzsche, 2001). Research has shown that interpreting the severity based on symptom descriptions alone is difficult (Wibring et al., 2019). Although chest pain is considered a cardinal symptom of heart disease (Wing & Schiffman, 2021), several patients diagnosed with MI do not report chest pain (Li & Yu, 2017; Waller et al., 2022). Along these lines, several patients in this study did not describe chest pain (B. Jensen et al., 2022, 2023a, 2023b). In line with Wibring et al (Wibring et al., 2019), the patients described chest pain in various ways potentially causing the call-takers to miss an impending MI (B. Jensen et al., 2023a, 2023b). Moreover, findings show different descriptions of chest pain in the last call compared to the penultimate call by the same patient (B. Jensen et al., 2023b). One possible reason for this could be deterioration of the condition. Another reason might be that the patient used different descriptions to explain an identical experience of chest pain. In addition, interpreting the condition based on a common symptom as back pain seemed to impede recognition of a severe condition warranting hospital referral (B. Jensen et al., 2022). One of the possible reasons for this may be that apart from back pain being a common symptom (Wu et al., 2020), it can also be an atypical symptom of heart disease (Gnesin et al., 2022; A. L. Møller et al., 2021; Wing & Schiffman, 2021). A probabilistic approach offers an understanding of why patients reporting back pain or lack of chest pain subsequently suffering OHCA or MI might be difficult to recognize.

Furthermore, recent research indicates that combination of symptoms, as opposed to one central symptom, might offer a more accurate indication of an impending OHCA (Gnesin et al., 2022). Following this, an approach to interpretation of the severity of a condition that allows symptom combinations could also prevent the patient from having to choose the most important symptom in case of complex conditions, as was seen in paper 3 (B. Jensen et al., 2022). Hence, the patient would not be expected to make a decision, they might not be qualified to carry out.

Findings indicate that patients' reaction to an unclear condition might be worry or insecurity. Furthermore, worry and insecurity seemed to facilitate negotiation of

response, including an invitation to let the patient decide if they wanted hospital admission or wait and see (B. Jensen et al., 2023a). Even though it was not an approach generally applied by the call-takers, it offers an understanding of an approach call-takers could apply to explore the feeling of worry or insecurity (B. Jensen et al., 2023a). Research has shown that a lack of exploring the feeling of being concerned might affect patient safety negatively (Ernesäter et al., 2015; Gamst-Jensen et al., 2018). Moreover, exploring patients' degree-of-worry may facilitate further medical information and might capture acutely ill patient's interpretation of urgency (Gamst-Jensen et al., 2018; A. N. Jensen et al., 2021; Stolper et al., 2022), and seems to be associated with subsequent hospital admission (Gamst-Jensen et al., 2020). System theoretically, letting the patient decide on choice of response indicates a paradox as the presumption is that only patients with medical problems in need of assistance contact the Copenhagen EMS, still some patients were asked to choose a response themselves as the reported condition appeared to be too complex for the prehospital setting to handle. The very expectation is that it should always be the system's responsibility to decide on a response.

## **4.2 DISCUSSION OF METHODOLOGY**

### **4.2.1 CRITICAL ASSESSMENT OF THE CONSTRUCTIVIST APPROACH**

To generate an understanding of the reaction to early signs of development of MI and OHCA, methodical constructivism was applied allowing to conduct a second-order observation of the communicative interaction between the patient and call-taker. This proved particularly useful for analysing how the patient interpreted the severity of the experienced condition expressed in the communicative interaction with the call-taker. Similarly, the second-order observation of the call-takers' decision-making process on choice of response allowed analysing how the call-takers interpreted the severity of the patients' experienced conditions.

Contrary to an ontological approach, where scientific concepts are understood as expression of reality and are assessed to what extent they have the capability of identifying challenges in empirical analyses in the form of the relationship between participant and structure, an epistemological point of view observes scientific concepts as tools applied to empirical analysis and through that solve challenges encountered in the analysis (Hagen & Gudmundsen, 2011). Through the application of a system theoretical approach, it became apparent that the reality that is accessible is the communicative interaction between patient and call-taker and not the actual condition in the patient's body. Drawing on Luhmann's understanding of communication as a synthesis of the three selections: information, utterance, and understanding or misunderstanding gave way to observe how the patients and call-takers constituted meaning in the patients' experienced conditions.

One limitation of a constructivist perspective is that the researcher could always choose different distinctions to observe with, thus gaining different cognitions. However, by applying methodological constructivism, critical reflections on the

interplay between theory, empiricism, and theory of science cause transparency and initiates that there must be a critical reflection on the above-mentioned conditions. Given the recognition that reality is always related to an observer's particular way of observing something, it becomes possible to reflect on whether the particular way of observing reality is a scientifically reasonable way to observe (Hagen, 1997). Considering the overall research objective, the second-order observation based on the distinction between severe/not severe condition proved useful to understand patients' and call-takers' reaction to early signs of the development of MI and OHCA. Moreover, the application of a stratified purposive sampling strategy made it possible to explore different aspects of how the severity of a reported condition was interpreted among different patients reporting the same symptom resulting in both inclusion and exclusion regarding offer of hospital referral (B. Jensen et al., 2022). Similarly, it was possible to explore the interpretation of the reported condition in the same patient initially referred to watchful waiting and only after repeated contact was offered hospital referral (B. Jensen et al., 2022, 2023a).

#### **4.2.2 SELECTION OF PATIENTS THROUGH REGISTRY-BASED DATA**

As the PhD study is registry-based, it was designed to identify patients through linkage across an administrative database at the Copenhagen EMS and different national registries. The selection of patients through registry-based data allowed for the successful inclusion of 37 patients with 60 calls suffering an MI or an OHCA. Survival to hospital discharge or 30-day survival among patients suffering an OHCA ranges between 10% and 24 % (Gräsner et al., 2016, 2020). Among patients diagnosed with MI, 30-day mortality ranges from 4.3% in patients reporting chest pain to 15.6% in patients with atypical patients (A. L. Møller et al., 2021). Hence, valuable knowledge could be missed if the empirical data was based on survivors' recollections in the form of a qualitative interview. As one in five patients is found to contact helpline services preceding an OHCA (Zylyftari et al., 2022), and half of the patients suffering ST-elevation MI contacted the EMS (Thylén et al., 2015) selection of patients based on contact to the Copenhagen EMS is likely to include a wide range of patients with various conditions. Following this, credibility and transferability would likely be facilitated as outlined by Shenton (Shenton, 2004). Furthermore, the identification of patients reporting back pain through a concurrent project (Gnesin et al., 2022) enabled the PhD study to present variations and complexities of back pain experiences preceding an OHCA, as numerous calls were screened.

Contradictory to previous studies (Canto et al., 2000; Khan et al., 2017; J. McSweeney et al., 2001; J. C. McSweeney & Crane, 2000; Watkins et al., 2021), gender- and age-related differences in prodromal symptoms prior to MI and OHCA were not identified in this PhD study. However, the purposive sampling strategy was not stratified according to gender or age. Hence, further exploration of possible differences would require a different sampling strategy than applied in this PhD study.

### 4.2.3 BENEFITS AND SHORTAGES OF AUDIO FILES AS EMPIRICAL DATA

An important strength of audio files as empirical data is the access to ‘real life’ information where neither the patient nor the call-taker know the subsequent course of events. Along these lines it is argued that audio files provide unselected and spontaneous descriptions of experienced conditions without risk of recall bias or risk of patients adjusting the descriptions to comply with the interviewer’s understanding of the researched phenomena (Wibring et al., 2019).

One limitation of audio files is that it was not possible to ask clarifying questions to either the patient or the call-taker. The data depended solely upon the unfolding communicative interaction between the patient and the call-taker. Even though the telephone consultation transcripts stem from audio files, the transcripts and document analysis might share some similarities. In addition, document analysis and content analysis can be understood to have common features (Bowe, 2009). Furthermore, I did not have access to the context surrounding each call i.e., medical history, which might have enhanced my understanding of the patients’ and call-takers’ interpretation of the severity. Moreover, I did not have the opportunity to test my interpretations through conversation with the participants. Because of this, some aspects of the patients’ and call-takers’ interpretations would perhaps not be captured by the analyses.

Contrary to a quantitative research design with a focus on recording symptoms (Gnesin et al., 2022; A. L. Møller et al., 2021; Zylyftari et al., 2022), a qualitative research design using audio files offers insight into the patients’ and call-takers’ unselected and spontaneous communicative interaction. This enables a second-order observation of the interpretation of the severity of the patients’ experienced conditions and constitutes the basis for the call-takers’ decision on choice of response.

To use the telephone consultations in the analysis, they were transcribed verbatim. While all verbal utterances were transcribed, non-verbal utterances and paralinguistic were not systematically transcribed, hence, aspects of the selection of utterances were not part of the analysis. The finding that worry and insecurity were an important part of patients’ interpretation of the severity of their experienced condition could perhaps have been unfolded in greater detail if paralinguistic had been part of the analysis. Along these lines interpretation of paralinguistic is found to be an approach applied by call-takers to compensate for lack of face-to-face interaction (Wouters et al., 2020). Across telephone consultations, the communicative interaction indicated that the call-taker paid attention to paralinguistic by asking questions or commenting on breathing problems and pain. The finding that call-takers seemed to request verbal utterances to assist the interpretation of the severity by asking the patient to translate pain into physical expressions could indicate that part of non-verbal utterances is reflected in the analysis (B. Jensen et al., 2022, 2023a, 2023b). Drawing on conversation analysis, a more detailed notation system in the transcriptions could have been applied (Denzin

& Lincoln, 2018), thus capturing non-verbal utterances and paralanguage systematically.

In some cases, the patients themselves were not the patient instead a spouse, a relative or a bystander made the call. This could potentially affect the interpretation of the severity of the patient's condition as there may be a discrepancy between the patient's experienced condition and how it is described to their significant others (Forslund et al., 2008; Johansson et al., 2007, 2008). Furthermore, it might be difficult for a significant other to relate the condition to cell-takers (Johansson et al., 2008). However, this is recognised by the Copenhagen EMS as the procedure is to ask to speak to the patient if the patient is not making the call. Given the patients participated in up to 93% of the calls, the audio files selected for this PhD study reflect the above-mentioned procedure and ensured that patients participated in the majority of the selected calls (B. Jensen et al., 2022, 2023a, 2023b).

#### **4.2.4 ANALYTICAL STRATEGY**

Qualitative content analysis was chosen as an analytical strategy. An important advantage of qualitative content analysis, as described by Schreier (Schreier, 2012), is a detailed step-by-step instruction for conducting the analysis making it easier to navigate the overall process. Furthermore, the empirical data used in the PhD study was suitable for qualitative content analysis.

The decision to apply qualitative content analysis also presented some challenges. One limitation was that the analytical process turned out to be more dynamic than presented by Schreier (Schreier, 2012). It was difficult to determine when one phase was completed, hence the process was more iterative. This was especially seen concerning the steps: building the coding frame, pilot phase, and the main analysis phase; thus, each step has not been kept strictly apart the way Schreier recommends (Schreier, 2012).

Through application of an abductive research strategy, the initial analysis started during the process of selecting patients and transcribing the calls facilitating reflections on empirical knowledge and theory. Qualitative content analysis with subsumption strategy proved useful for building coding frames in accordance with an abductive research strategy allowing main categories to be generated deductively based on theoretical understandings and subcategories to be generated deductively based on empirical findings. Even so, the iterative analytical process challenged the understanding of whether categories were generated deductively or inductively, which was reflected in the dynamic and complex process of building the coding frames for each paper.

Given multiple conceptualisations of qualitative content analysis in the literature (Schreier et al., 2019, 2020), other approaches might have solved some of the challenges encountered in this PhD study. However, all three coding frames proved highly useful for analysing the overall objective of the PhD.

## 4.2.5 TRUSTWORTHINESS

Inspired by Shenton's strategies for assessing trustworthiness in qualitative research (Shenton, 2004), *credibility*, *transferability*, *dependability*, and *confirmability* will be discussed.

*Credibility* expresses the congruence between the studied phenomenon and the reality and is equivalent to internal validity in quantitative research (Shenton, 2004). To ensure credibility several measures were taken. A preliminary visit to the Copenhagen EMS ensured development of familiarity with the setting of the PhD study and allowed for valuable knowledge on how call-takers conduct telephone consultations and call-takers' reflections on the navigation of decision support tools. Even though the stratified purposive sampling strategy was applied according to chosen response, the included patients ensured substantial variation in which symptoms were reported and how they were described. In addition, both females and males with great variation in age were included. Moreover, both calls made to the 1813-medical helpline and the emergency number 1-1-2 were represented. The risk of researcher bias when selecting participants (Shenton, 2004) is likely to have been minimized by the illustrated variation in the included patients. Furthermore, presentation of preliminary findings resulted in constructive feedback from experienced researchers within this specific research field enabling refinement of the research design. Lastly, in order to evaluate the credibility (Shenton, 2004), the findings have been related to existing research in all three papers.

*Transferability* refers to whether the findings apply to other settings and corresponds external validity in quantitative research (Shenton, 2004). The PhD study was conducted using audio files from Copenhagen EMS. Although the organisation of the prehospital setting in the Capital Region of Denmark differs from the rest of the country, the function of the Copenhagen EMS is similar to other prehospital settings in Denmark (Vinge og Susanne Reindahl Rasmussen, 2018). Furthermore, in other European countries, the prehospital setting is organised similarly (Anderson & Roland, 2015; Deakin et al., 2017; Kaminsky et al., 2017; Smits, Rutten, et al., 2017). Hence, it is reasonable to believe that the findings can be generalized to other prehospital settings. Furthermore, the PhD study offers detailed descriptions of the patients' experienced symptoms and patients' and call-takers' interpretation of the severity of the patients' experienced conditions allowing a critical assessment of the transferability of the findings to another setting. However, as described above, further research on possible gender- and age-related differences and subsequent interpretation of the severity is needed.

*Dependability* addresses the possibility of repeating the work undertaken in a qualitative study given a detailed report of the research process and refers to reliability in quantitative research (Shenton, 2004). Attention to ensure dependability was pursued through transparency in methodological considerations throughout the research process including clear statement of the research objective, descriptions of the applied theoretical framework, detailed descriptions of the setting, the sampling

process, and the data analysis as well as the study's strengths and limitations. Furthermore, drawing on methodological constructivism facilitates critical reflections on the applicability of the applied way of observing reality. This allows readers to critically assess the dependability.

*Confirmability* refers to whether the findings are based on empirical data rather than the researcher's personal preferences, thus corresponding to objectivity in quantitative research (Shenton, 2004). The findings in each paper are supported by numerous quotations from various patients often complemented by descriptions of the context surrounding the quotations making it possible for the reader to examine the confirmability. Furthermore, in paper 1, an illustration of how the coding frame was generated, including examples of the link between the different elements of the coding frame is shown (B. Jensen et al., 2023a). This can be seen as a way to enable readers to trace the research process and thereby add to the confirmability (Shenton, 2004).





## CHAPTER 5. STUDY IMPLICATIONS

The findings of this PhD study are particularly relevant to stakeholders involved in the prehospital telephone consultation setting both health professionals working as call-takers as well as stakeholders responsible for the operations of prehospital telephone consultations. Furthermore, the findings are also relevant to other health professionals working with telephone consultations such as general practice.

Overall, findings from this PhD study highlight conditions where the identification of a severe condition turned out to be difficult.

On an interactional level, the professional call-taker must be aware that patients might not experience symptoms or describe the experienced symptoms following the professional understanding of prodromal symptoms associated with MI and OHCA. To facilitate faster recognition of severe conditions, it is crucial that the professional call-taker can consider this in the communicative interaction with patients. Moreover, the call-taker needs to be attentive to unclear and complex symptoms presentations, as they pose a specific challenge for the patient to describe, understand and interpret, hence for the call-taker to understand and interpret. Furthermore, understanding how different levels of health literacy might impact the patient's competence to describe, understand and interpret the experienced condition is likely to support the communicative interaction.

In line with this, the findings demonstrate the importance of the call-taker's ability to set aside the patient's interpretation and explore the severity of the condition independently of the patient's assessment, especially when the patient applies technical terms, as the patient's understanding of technical terms may not correspond to the professional understanding.

The findings highlight the need to assist call-takers in applying communicative skills that encourage the exploration of unclear symptoms or complex conditions to facilitate recognition of severe conditions. Findings also emphasize the significance of incorporating the patient's reaction to unclear symptoms as a relevant aspect of the decision-making on choice of response.

On an organisational level, findings highlight dilemmas in applying decision support tools in the assessment of the severity, especially in case of unclear symptoms or complex conditions. Decision support tools in the present form may not always assist the call-taker's recognition of an evolving MI and OHCA, hence, the call-takers applied different approaches to handle decision-making on choice of response when the decision support tool did not seem to assist. Consequently, findings indicate that the stakeholders responsible for the operations of prehospital telephone consultations might not recognize this limitation in the use of decision support tools. Hence, there seems to be a potential for learning by facilitating reflection on potential revisions of the decision support tools. Moreover, implementation of watchful waiting in a more

standardized form might facilitate faster recognition of a severe condition in case of unclear symptoms.

Even though the system's understanding of the function of the 1813-medical helpline is to manage non-emergency medical problems as opposed to the emergency number 1-1-2, the findings also emphasize the awareness that patients do not necessarily follow this logic. Patients may contact the 1813-medical helpline to be assisted in the interpretation of the severity, not because the condition is not severe, as the interpretation of unclear symptoms and complex conditions is difficult for the patient. From the health system's perspective, this could present a barrier to interpreting the severity of the patient's experienced condition.





## CHAPTER 6. CONCLUSION

The objective of this study was to gain knowledge on how patients observe, describe, understand, and interpret early warning signs of MI and OHCA expressed in telephone consultations preceding suffering a MI and OHCA. In addition to this, to gain knowledge on how call-takers react to the patients' experienced condition through observation of the decision-making process on choice of response.

Findings show that the patient's descriptions of unclear symptoms and complex conditions make it difficult to interpret the severity of the experienced condition, both from the patient's perspective and the call-taker's perspective. Even though patients actively try to interpret the experienced condition, they face challenges when the experienced condition appears unclear from the call-taker's perspective, causing the patient to be worried and insecure (B. Jensen et al., 2023a). Moreover, the communicative interaction is influenced by patients describing conditions not easily corresponding to the health system's understanding of prodromal symptoms associated with MI and OHCA. In particular, findings suggest that conditions not resulting in an offer of hospital referral are characterized by complex symptom descriptions that do not seem to match the health system's interpretation of a severe condition (B. Jensen et al., 2022).

On an organisational level, findings highlight dilemmas in applying decision support tools in the assessment of the severity. Decision support tools can be seen as an example of an analytical problem-solving approach based on context-independent rules and principles. An analytical problem-solving approach appears to be efficient when handling well-defined problems with well-established solutions but less efficient when dealing with problems less defined. The transformation of the patients' descriptions of their experienced conditions to conditions corresponding to symptom descriptions in the decision support tools seems particularly challenging in case of unclear symptoms or complex conditions causing the call-taker to misinterpret the severity of the condition. Hence, reflects cases where an analytical problem-solving approach seem incapable in assisting the call-taker to make a correct assessment of the reported condition. When the patients' experienced conditions do not correspond to the rationale of the decision support tool, the call-takers make use of different approaches in the form of negotiation of response, recommended follow-up, assurance against misinterpretations, and postponement of evaluation of the severity (B. Jensen et al., 2022, 2023a, 2023b).

Findings from this PhD study demonstrate that patients may not contact the service at the Copenhagen EMS corresponding to the severity of the experienced condition. While the structure of the Copenhagen EMS with the emergency number 1-1-2 for severe conditions and the 1813-medical helpline for not severe conditions presumes that patients can make this distinction when interpreting their experienced conditions, findings show that patients call the 1813-medical helpline because they need assistance in interpreting the severity, not because the experienced condition is not severe (B. Jensen et al., 2022, 2023a, 2023b).

Finally, the decision-making process on choice of response can be understood based on the distinction between risk and danger. In cases with well-defined medical problems interpreted as severe by the call-taker, the decision to dispatch an ambulance is likely to indicate cases where the call-taker mark the danger. Conversely, in cases with unclear symptoms, the call-taker seems more inclined to mark the risk and thereby allow dangers to be forgotten by arguing that the experienced condition is not severe. However, findings suggest that negotiation of response occurs when the patient and call-taker mark the other side of the same distinction in the communicative interaction, but because the decision-making capacity lies with the call-taker the patients can't overrule the call-taker's assessment of the severity of the experienced condition.







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