

# Symptoms of Acute Myocardial Infarction as Described in Calls to Tele-Nurses and in Questionnaires

## A Mixed-Methods Study

Karin Hellström Ångerud, RN, PhD; Maria Ericsson, RN, MSc; Margareta Brännström, RNT, PhD; Sofia Sederholm Lawesson, MD, PhD; Anna Strömberg, RN, PhD; Ingela Thylén, RN, PhD

**Background:** Patient-reported symptoms of acute myocardial infarction (MI) may be affected by recall bias depending on when and where symptoms are assessed. **Aim:** The aim of this study was to gain an understanding of patients' symptom description in more detail before and within 24 hours after a confirmed MI diagnosis. **Methods:** A convergent parallel mixed-methods design was used to examine symptoms described in calls between the tele-nurse and the patient compared with symptoms selected by the patient from a questionnaire less than 24 hours after hospital admission. Quantitative and qualitative data were analyzed separately and then merged into a final interpretation. **Results:** Thirty patients (median age, 67.5 years; 20 men) were included. Chest pain was the most commonly reported symptom in questionnaires (24/30). Likewise, in 19 of 30 calls, chest pain was the first complaint mentioned, usually described together with the symptom onset. Expressions used to describe symptom quality were pain, pressure, discomfort, ache, cramp, tension, and soreness. Associated symptoms commonly described were pain or numbness in the arms, cold sweat, dyspnea, weakness, and nausea. Bodily sensations, such as feeling unwell or weak, were also described. Fear and tiredness were described in calls significantly less often than reported in questionnaires ( $P = .01$  and  $P = .02$ ), whereas "other" symptoms were more often mentioned in calls compared with answers given in the questionnaire ( $P = .02$ ). Some symptoms expressed in the calls were not listed in the questionnaire, which expands the understanding of acute MI symptoms. The results showed no major inconsistencies between datasets. **Conclusion:** Patients' MI symptom descriptions in tele-calls and those reported in questionnaires after diagnosis are comparable and convergent.

**KEY WORDS:** mixed methods, myocardial infarction, patient experiences, symptoms

Symptom recognition and interpretation have significance for a patient's decision to seek medical care when experiencing a myocardial infarction (MI).<sup>1–3</sup> Patients' vital signs and symptoms also form the basis for

the healthcare personnel's actions concerning people with suspected MI. A thorough symptom history is especially important at the patient's first medical contact, when a working diagnosis should be made and decisions

### Karin Hellström Ångerud, RN, PhD

Senior Lecturer, Department of Nursing, Umeå University, Umeå, Sweden.

### Maria Ericsson, RN, MSc

PhD student, Department of Cardiology, Linköping, and Department of Health, Medicine, and Caring Sciences, Linköping University, Linköping, Sweden.

### Margareta Brännström, RNT, PhD

Professor, Department of Nursing, Umeå University, Campus Skellefteå, Umeå, Sweden.

### Sofia Sederholm Lawesson, MD, PhD

Department of Cardiology, Linköping, and Department of Health, Medicine, and Caring Sciences, Linköping University, Linköping, Sweden.

### Anna Strömberg, RN, PhD

Professor, Department of Cardiology, Linköping, and Department of Health, Medicine, and Caring Sciences, Linköping University, Linköping, Sweden.

### Ingela Thylén, RN, PhD

Associate Professor, Department of Cardiology, Linköping, and Department of Health, Medicine, and Caring Sciences, Linköping University, Linköping, Sweden.

The authors have no funding or conflicts of interest to disclose.

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

### Correspondence

Karin Hellström Ångerud, RN, PhD, Department of Nursing, Umeå University, 901 87 Umeå, Sweden (karin.hellstrom.angerud@umu.se).

DOI: 10.1097/JCN.0000000000000873

taken on the level of care.<sup>4</sup> In MI, especially ST-elevation MI (STEMI), a correct diagnosis and rapid treatment are extremely important as these affect the patient's prognosis.

Treatment with primary percutaneous coronary intervention should be initiated less than 90 minutes of first medical contact.<sup>4</sup> Nonetheless, the time from symptom onset to reperfusion therapy is often longer than the recommended time,<sup>5</sup> and most of the delay from symptom onset to diagnosis is because of patient delay.<sup>6</sup> One reason is that patients experiencing MI symptoms contact a tele-nurse for advice, instead of immediately calling the emergency medical services (EMS).<sup>6</sup> In many countries, tele-nursing has become an integrated part in the healthcare system where the nurses answer questions, give self-care advice, and/or refer the caller to an appropriate level of care.<sup>7</sup> This service is intended for non-life-threatening situations. For example, in Sweden, such a service number—called the Healthcare Guide 1177—is available 24 hours a day. To assist in counseling, the tele-nurses have a computerized decision support system. This service to the citizens is free of charge and a part of the healthcare throughout the country. All calls are audio recorded and handled as medical records.<sup>8</sup>

Previous research has shown that symptom interpretation and the decision-making process for care seeking by patients with MI symptoms are multifaceted,<sup>9–12</sup> and more knowledge of this complex field is needed. In the literature,<sup>4,13–15</sup> and in information to the general public,<sup>16,17</sup> MI symptoms are often described as persistent chest pain, which may radiate to the neck, lower jaw, or left arm. Other symptoms, which can occur together with chest pain or alone, are shortness of breath, nausea or vomiting, cold sweats, fatigue, palpitations, syncope, and a general sick feeling.<sup>4,16</sup> The symptoms can sometimes be vague and can vary from persistent to intermittent.<sup>4,15</sup>

Studies describing MI symptoms are often retrospective and based on patient interviews, self-reported survey data, or registries.<sup>18–20</sup> In studies based on interviews or surveys, patients are asked about their symptoms after being diagnosed with MI, often days or weeks after falling ill. During this time, they have reflected on and described their symptoms on several occasions; furthermore, healthcare personnel may have asked about chest pain specifically. This could affect a patient's own immediate interpretation, as he or she learns which symptoms appear to be important and relevant in relation to an MI diagnosis. Findings derived from observational registry data are usually based on a limited number of predetermined symptom alternatives that are part of the specific registry.<sup>20</sup> Participation is, in turn, often based on the patient's medical record, and the documentation of symptoms in the medical record may be affected by the healthcare personnel's conceptions of MI symptoms.<sup>21</sup> Few have examined ACS symptoms in real time, but a prospective study

by DeVon et al<sup>22</sup> assessed symptoms on presentation to the emergency department, within 15 minutes, and before treatment. In their study, symptoms were assessed with the 13-item ACS Symptom Checklist. Although DeVon et al<sup>22</sup> assessed symptoms in real time, patients were still selecting symptom descriptors from a checklist. To deepen the knowledge about symptoms of MI and how they are described by patients, there is a need for studies describing MI symptoms in the patient's own words and before they are diagnosed with MI. Hence, our aim was to gain an understanding of patients' symptom description in more detail before and within 24 hours after a confirmed MI diagnosis.

## METHODS

### *Study Design, Participants, and Setting*

In this secondary analysis, we used a convergent parallel mixed-methods design.<sup>23</sup> For the quantitative analysis, we used data from the SymTime study,<sup>19,24</sup> which was a cross-sectional study to examine sex differences in patient delay and symptom presentation in acute MI patients. For the qualitative analysis, we used data from the SymTime II study,<sup>25</sup> which was a qualitative study exploring the interaction between tele-nurses and callers with an evolving MI after contacting a national telehealth advisory service number as their first medical contact.

In the SymTime study, patients 18 years or older diagnosed with acute MI were invited to participate. Exclusion criteria were difficulties reading and speaking Swedish. Those agreeing to participate received the questionnaire within 24 hours after admission to the hospital, resulting in 694 included patients. In the SymTime II study, patients were eligible for study inclusion if they (a) in the SymTime study had stated that they contacted a tele-nurse in the southeast catchment area in Sweden as their first medical contact when experiencing MI symptoms and (b) represented themselves during the call. This resulted in 30 included patients. Data were collected between November 2012 and January 2014.

For this secondary analysis, we have integrated data from the audio-recorded calls that include descriptions of symptoms by the patients and data from the same patient given in the questionnaire that included questions about symptoms, resulting in 30 patients.

The study complies with the Declaration of Helsinki<sup>26</sup> and ethical permissions were obtained from the Regional Ethical Review Board, Linköping, Sweden (2016:14-31, 2012/201-31, 2012/338-32).

### *Measures*

#### *Quantitative Data*

The previous validated questionnaire<sup>6</sup> covered 35 items including (1) baseline characteristics, (2) symptoms, (3)

course of events, and (4) first medical contact and transport mode to the hospital. Questions regarding symptoms included pain and its location (eg, radiating to the back, stomach, left arm) and 10 additional symptoms (eg, anxiety, generally feeling sick, dyspnea), symptom character (eg, oppressive, dull or burning pain), experience of symptoms (eg, unpleasant, unbearable, frightening), pain intensity (eg, fluctuating, constant, increasing), interpretation of symptoms (ie, cardiac in origin or not cardiac in origin; muscles, lungs, gall bladder, ordinary cold, stomach, back, teeth/jaw, other), whether the patient had experienced prodromal symptoms (symptoms before the current event, yes/no), how long time before (<1 week, 1–2 weeks, 3–4 weeks, 1–2 months, >2 months), and how often (several times a day, once a day, 3–6 times a week, >6 times a week).

### Qualitative Data

The qualitative data consisted of audio-recorded calls between callers who were later diagnosed with acute MI and tele-nurses at the Swedish Healthcare Guide 1177.

### Analysis

Initially, we analyzed the quantitative and qualitative data separately and then merged them into a final interpretation to gain a deeper understanding of acute MI symptoms according to the steps described by Creswell and Clark.<sup>23</sup>

### Quantitative Analysis

The statistical analyses were performed using SPSS version 25.0 for Windows. Descriptive statistics with frequencies, percentages, median, and range were used to describe participant characteristics, symptoms, and symptom interpretation reported in the questionnaire.

### Qualitative Content Analysis

The calls were transcribed verbatim and analyzed using qualitative content analysis.<sup>27–29</sup> First, the first author listened to all the recordings several times and read through the transcripts carefully. Sentences and paragraphs capturing the research aim were identified, and further condensed and labeled with codes. Meaning units were compared across data, and patterns and contradictions were identified. Next, 4 categories capturing the acute MI symptoms and their context were constructed. Quotations representing the data were selected and presented in the results. Consensus was reached using analyst triangulation by 3 of the authors, including the author who developed the original questionnaire.

### Mixed-Methods Analysis

Quantitative results with symptom presentation and interpretation in the questionnaire (after diagnosis) were compared with symptom descriptions derived from the qualitative data in audio-recorded calls (before diagnosis). We used the McNemar test to calculate *P* values

for paired data. A *P* value <.05 was considered significant. Further analysis and interpretation of the results were performed to determine whether the results were comparable and convergent, whether the mixed data expanded the understanding of acute MI symptoms, or whether the results were inconsistent.<sup>23</sup>

## RESULTS

### Clinical Characteristics

In all, 20 men and 10 women with MI (whereof 24/30 had STEMI), with a median age of 67.5 years, participated in this mixed-methods analysis. Clinical characteristics are further described in Table 1.

### Quantitative Findings

In the questionnaire, the patients reported a median of 4.5 symptoms (range, 2–17). Most (24/30) described chest pain, 13 of 30 experienced radiating pain to the throat or neck, 11 of 30 to the arms/hands, 4 of 30 to the jaw or teeth, 3 of 30 to the back, 4 of 30 to the stomach, and 4 of 30 to the shoulders. Associated symptoms reported were numbness in arms/hands (7/30), tiredness (10/30), weakness (11/30), dyspnea (10/30), vertigo/presyncope (8/30), nausea/vomiting (8/30), cold sweat (11/30), anxiety (4/30), fear (10/30), general feeling of illness (9/30), and other symptoms (1/30) (Table 2). The median pain rating of the most severe symptom was 6.0 (range, 0–9) on the numeric rating scale, and 19 of 30 interpreted the symptoms as originating from the heart.

### Qualitative Findings

The calls lasted on average 5:10 minutes (range, 0:39 to 16:44 minutes). The qualitative analysis resulted in 4 categories: initial complaint and context description, expressions for quality of symptoms in the chest, intensity and severity of symptoms, and associated symptoms and bodily sensations.

### Initial Complaint and Context Description

Commonly, the conversation started with the patients giving, or being asked to give, a symptom description. In 19 of 30 calls, pain, or other sensations such as pressure, discomfort, tension, or cramp in the chest, was the first complaint mentioned, and it was usually described together with the time of symptom onset: “I woke up an hour ago with strong chest pain and it hasn't gotten less yet” (interview 1). Callers who did not mention a clear symptom as their first complaint, reported bodily sensations such as feeling weird or very weird, feeling very ill, or having a strange feeling in the arms, to convey their symptoms, as described in more detail in Table 3.

In addition to the first described symptom, some callers also added information about what they were doing at the time of onset, and how the symptom or complaint

affected them: “Well, I was shoveling snow today, and then I got so much pain in my chest and in my whole body, and I got so very sweaty that I had to go and lie down” (interview 26).

**Expressions for Quality of Symptoms in the Chest**

In total, 25 of 30 callers described chest pain or similar sensations such as pressure and discomfort at some time during the conversation with the tele-nurse; this was thus the most commonly described symptom. Of the 11 callers who did not mention chest pain at the beginning of the call, 4 described chest pain later in the conversation, and 2 after probing questions from the tele-nurse. The most common expressions used for describing the quality of the chest symptom were pain (14/25) and pressure (7/25). Other expressions used were discomfort, ache, cramp, tension, and soreness. Some of the callers did not include chest pain in their symptom description (5/30); some even denied any kind of pain or pressure in the chest: “But I don’t have pressure in the chest if that is what you are thinking about” (interview 10).

**Intensity and Severity of Symptoms**

Most (20/30) of the callers described the symptoms as very uncomfortable, or very strong, and sometimes described it together with associated symptoms. They used expressions to underline the intensity of the symptoms, such as severe, very much, very strong, terribly, like hell, copiously, really uncomfortable, disgusting, and cannot cope anymore, as described in the following 2 quotations: “Last night, I got pain in the chest, in the middle of the chest and my forehead became sweaty and I felt really terrible” (interview 22), and “It was really uncomfortable, so I had to keep walking around and didn’t get any rest” (interview 20). Furthermore, some callers used expressions not only to underline the intensity of symptoms but also to describe feelings of fear and anxiety: “And now I’m starting to get worried about what this might be” (interview 14) or that the night sleep had been affected: “I’ve a lot of pain in my chest and

**TABLE 2 Paired Comparisons in Symptom Presentation, Described in Calls and Reported in Questionnaires (N = 30)**

Symptoms	Calls	Questionnaires	P <sup>a</sup>
Pain, discomfort, or pressure location			
Chest or thorax	25 (83.3)	24 (80.0)	1.00
Throat or neck	7 (23.3)	13 (43.3)	.07
Jaw or teeth	2 (6.7)	4 (13.3)	.62
Back	2 (6.7)	3 (10.0)	1.00
Stomach	1 (3.3)	4 (13.3)	.25
Shoulders	7 (23.3)	4 (13.3)	.38
Arms/hands	12 (40.0)	11 (36.7)	1.00
Other symptoms			
Numbness in arms/hands	2 (6.7)	7 (23.3)	.06
Tiredness	2 (6.7)	10 (33.3)	.02
Weakness	8 (26.7)	11 (36.7)	.58
Dyspnea	8 (26.7)	10 (33.3)	.75
Vertigo/presyncope	3 (10.0)	8 (26.7)	.60
Nausea/vomiting	8 (26.7)	8 (26.7)	1.00
Cold sweat	12 (40.0)	11 (36.7)	1.00
Anxiety	4 (13.3)	4 (13.3)	1.00
Fear	1 (3.3)	10 (33.3)	.01
General feeling of illness	3 (10.0)	9 (30.0)	.11
Other	8 (30.0)	1 (3.3)	.02

Data are presented as n (%).

<sup>a</sup>Differences between audio-recorded calls and questionnaires, tested with the McNemar test for paired data.

left arm and a little in my right arm. It started already at one, so I haven’t slept at all” (interview 24).

In a few cases (2/30), symptoms in the chest were described as a rather mild complaint, and they talked about heart trouble instead of chest pain, like: “My heart’s troubling me a bit” (interview 23) or “I think I’ve got a sensation angina” (interview 30).

**Associated Symptoms and Bodily Sensations**

Commonly described associated symptoms—often together with chest pain—include pain or numbness in the arms (14/30), cold sweat (12/30), dyspnea (8/30), weakness (8/30), and nausea (8/30). Bodily sensations were also described (12/30) in terms of not feeling well, or feeling weak, such as: “I became so weak and then I started to sweat, copiously and...feeling very weak and...” (interview 18). Others described their symptoms in more vague terms, such as a general sick feeling. Some callers (4/30) used the word “weird” in their description of the bodily sensations, and they were all women:

I haven't slept at all last night and I feel very weird...and now when I'm sitting up, I feel okay, but when I lay down..., I have no pain inside the throat, but outside the throat...in the front, and I think I'm tense because I have pain in the arms also, from the elbow and... (Interview 10)

The bodily sensations were described both in combination with or without descriptions of pain, discomfort, or pressure in the chest. Some callers expressed that the symptoms were like nothing they had ever experienced before; some had difficulty verbalizing the

**TABLE 1 Clinical Characteristics of Patients (N = 30)**

Description	
Age, median (range), y	67.5 (46–89)
Sex, male/female, n	20/10
Married/cohabiting, n	21
Educational level, >9 years, n	16
Current cigarette use, n	5
Diabetes, n	5
Hypertension, n	15
Angina pectoris, n	4
Previous myocardial infarction, n	2
Diagnosis: STEMI/NSTEMI, n	24/6

Abbreviations: STEMI, ST-elevation myocardial infarction; NSTEMI, non-ST elevation myocardial infarction.

**TABLE 3** First Described Symptom or Complaint and Expressions Used to Underline Intensity of Symptoms in Calls and Correlating Pain/Pressure/Uncomfortable Intensity (Numeric Rating Scale) Reported in the Questionnaire (N = 30)

Patient (Sex)	First Described Complaint	Expressions Used to Underline Intensity of Symptoms	NRS
1 (M)	Severe chest pain	Severe chest pain	8
2 (M)	Pressure high up in the chest	Very strong discomfort	7
3 (M)	Chest pain	It doesn't feel good	7
4 (M)	Feeling bad	Feel so damn bad	4
5 (M)	Pain in the chest	It was very difficult	6
6 (M)	Pain, comes and goes, a little hard to breathe	-	2
7 (F)	Palpitations and cramp in the chest	-	4
8 (M)	Nausea and vomiting	Feeling very weak	6
9 (M)	Pain in the chest	-	7
10 (F)	Feeling really weird	Feeling really weird	7
11 (F)	Don't feel very well	-	0
12 (M)	Pressure in the chest	-	2
13 (M)	Chest pain, it runs out in my arm	-	4
14 (M)	Stomach and pain in the chest	It has been like hell, feels disgusting	7
15 (M)	Trouble with the heart	Bloody painful	7
16 (M)	Chest pain	-	8
17 (M)	Pressing, cramp in the chest	-	5
18 (F)	Got weak, sweating copiously	-	3
19 (F)	Strange feeling in arms	-	3
20 (M)	Neck, shoulder, and chest tension	It felt very uncomfortable, it felt damn uncomfortable	5
21 (F)	Pressure over the chest	I am very nauseous	5
22 (M)	Pain across the chest	I felt really terrible, it was really strong	4
23 (F)	Heart trouble	It hurts a lot	7
24 (M)	So much pain in chest, left arm, little in right arm	So much pain, it gets worse and worse	7
25 (F)	Discomfort in the chest	I feel so weird	9
26 (M)	Such a lot of pain in the chest	Such a lot of pain	6
27 (F)	Chest pain.	I can no longer bear it	8
28 (F)	Feeling weird, heart beats so terribly	Heart beats so terribly.	7
29 (M)	Feeling really bad, dry mouth	Feeling really bad, I feel worse and worse	7
30 (M)	Sensation of angina	Clear feeling of malaise, uncomfortable	6

NRS: 11-point scale, ranging from 0 to 10.

Abbreviations: F, female; M, male; NRS, numeric rating scale.

bodily sensations and did not know how to explain the symptoms or sensations:

It went on, like the whole shoulder part as well, it felt very uncomfortable then. Right now, there are only after-effects left, and especially then in the upper part, on the chest muscles, and then up towards the shoulder, or towards the shoulder muscle. It feels a little bit like, that it's..., well I don't know how to explain it. (Interview 20)

For some, the onset of symptom was described as sudden, and for others, symptoms had come and gone for hours up to days: "It [the pain] disappeared during the night so I could sleep after about half past one. I sat in the kitchen...and then last night I had it [pain] too, but then I didn't take any nitroglycerin" (interview 7).

### Mixed-Methods Results

As described in Table 2, pain, discomfort, or pressure in the chest was the most common symptom reported in calls as well as questionnaires. There were no significant differences in paired data between datasets (25/30 vs 24/30,  $P = 1.0$ ), which made the results comparable and convergent. Of the 6 callers who did not describe

chest pain in the call, 5 did not report discomfort, pressure, or pain in the chest in the questionnaire either, although one did describe tension in muscles in the chest during the call. Fear and tiredness were significantly less often described in calls than later reported in questionnaires (1/30 vs 10/30,  $P = .01$ , and 2/30 vs 10/30,  $P = .02$ , respectively), whereas "other symptoms" were more often mentioned in calls compared with the answers in the questionnaires (8/30 vs 1/30,  $P = .02$ ). Otherwise, there were no significant differences in paired data between numbers of symptoms described in calls and later reported in questionnaires. Some callers expressed symptoms in the calls that were not listed in the questionnaire, and this information expands the understanding of acute MI symptoms. These were palpitations (3/30), sore muscles (3/30), feeling warm (2/30), feeling cold (1/30), headache (1/30), and diarrhea (1/30). The results showed no major inconsistencies between datasets.

Pain or symptom intensity of the most severe symptom was rated as 6 or higher on the numeric rating scale in the questionnaire by 18 of 30 participants. Of those, 16 of 18 used expressions (eg, very strong, damn bad,

very difficult) to underline or strengthen their symptom description in the calls (Table 3).

## DISCUSSION

This study used unique data recordings of ongoing calls to Healthcare Guide 1177 from patients with acute MI and compared those data with the same patients' questionnaires filled out after admission to the hospital. We found that for patients with MI who called a tele-nurse, descriptions of chest pain were the most common symptom. This is in line with previous results from studies based on questionnaires and medical records.<sup>20,30–32</sup> For most patients in our study, there was good consistency between symptoms reported in calls and symptoms reported in questionnaires, with 2 exceptions: fear and tiredness. These symptoms were more often reported in questionnaires than described in the calls. The reason for that is not clear, but one explanation might be that during the calls, these symptoms were overshadowed by more intense experiences such as pain and cold sweat. When the patients later filled out the questionnaire, they had an opportunity to reflect on their experience and include all sensations and symptoms. Other explanations might be that fear and tiredness may not have been evident to patients until after a decision was made to go to the hospital for treatment. Alternatively, when filling out the questionnaire, patients also included prodromal symptoms, whereas in the calls, they mainly talked about current, ongoing symptoms.

In the present study, a variety of associated symptoms were described, often together with chest pain or other expressions of pain. This finding is supported by previous research describing that patients with acute coronary syndrome often present with a variety of symptoms and that symptoms occur in clusters.<sup>33</sup>

Our results further show that there was no difference between calls and questionnaires regarding the percentage of patients reporting chest pain (about 80%). This was a somewhat unexpected but positive finding as we used real-world data from ongoing calls, unlike previous studies that have used prospectively collected data from interviews, structured questionnaires, or medical records. Our results indicate that the description of chest pain does not change substantially over time after the first medical contact and after receiving their MI diagnosis; this has, to our knowledge, not been described previously. The results also indicate that the questionnaire used in the SymTime study has good reliability and validity for describing the symptoms of MI. In the SymTime study, patients filled out the questionnaire within 24 hours after admission to hospital,<sup>6</sup> which may also have contributed to the relatively good coherence between calls and questionnaires. A study of Davis et al<sup>34</sup> found that patients' recall of time of symptom

onset are more likely to be congruent with documentation in the medical record the closer the event is to the time patients are asked about it.<sup>34</sup>

Previous research has also examined the consistency between patient-reported symptoms in interviews and symptoms documented in medical records.<sup>21</sup> They found good agreement between the patient's report and medical record regarding chest pain in MI, but not for other symptoms. DeVon et al<sup>21</sup> argue that chest pain is a symptom relevant for MI and, therefore, is documented in medical records, whereas other symptoms like fatigue are rarely documented. Consequently, medical records might not be an accurate source of data on patients' experiences of MI symptoms.<sup>21</sup>

The present study also adds knowledge that many patients use words to strengthen and underline the intensity of the experienced symptoms in their communication with tele-nurses. This could be interpreted as the patients trying to grade their pain without awareness of the numeric rating scale used in medical care. This finding corresponds with the high pain rating reported in the questionnaire, and that 89% of the patients who had rated their pain as 6 or higher also described their symptoms as “very bad, strong, or severe” in the dialogue with the tele-nurse. Severe pain intensity was also found in several calls in a Swedish study analyzing calls to EMS in individuals with chest pain and high-risk conditions such as acute coronary syndrome, pulmonary embolism, aortic aneurysm and dissection, and spontaneous pneumothorax.<sup>35</sup> It is important for tele-nurses to be aware of the described pain intensity when assessing symptoms suggestive of MI. The tele-nurses can ask the caller to rate their pain because previous research has found a possible, higher likelihood of an MI diagnosis if the patient has high visual analog scale scores at the first prehospital assessment.<sup>36</sup> The results of this study and others indicate that not all MI patients present with severe chest pain or other traditional MI symptoms.<sup>37</sup> One study on calls to a Medical Hotline in Denmark found that nonnormative symptom description, described as nontextbook symptoms, or when the caller failed to communicate a clear problem, contributed to undertriage of the calls.<sup>38</sup> This highlights the difficulty of assessing people with suspected MI. Tele-nurses have routines for working systematically and have decision support systems to use when assessing calls,<sup>8</sup> but they still need to rely on the patient's narrative in the assessment, without the opportunity to complement the assessment with physical examinations or 12-lead electrocardiogram. In an interview study with tele-nurses in Sweden, an inability to see the caller in person was described as problematic in the assessment, and the authors argue that it can be a threat to patient safety.<sup>39</sup> However, the use of video calls to communicate with patients has recently become more common, and hopefully, this can also be used as a tool in tele-nursing and EMS settings.

### What's New and Important

- Chest pain is the most common symptom described both in calls to a tele-nurse and reported in questionnaires after diagnosis, and this does not change substantially over time.
- Symptoms of fear and tiredness were more often reported in questionnaires than described in calls.
- In the communication with tele-nurses, many patients use words to strengthen and underline the intensity of experienced symptoms; thus, nurses need to be aware of pain intensity when assessing symptoms suggestive of MI and ask patients to rate their pain.

Our results show that some people had difficulty describing their symptoms or verbalizing their bodily sensations. From previous research, we know that communication in the interaction between tele-nurses and callers is complex<sup>25,38,40</sup> and that descriptions of symptoms are a significant part of the interaction. The calls in this study were all to a tele-nurse, and this may have affected the results as it is likely that people who are uncertain about how to understand and interpret their symptoms will call a tele-nurse rather than an ambulance directly. Knowledge and beliefs about the threat that the symptoms pose to one's health and how serious one thinks they are affect when people seek care,<sup>41</sup> and probably also the instance to which they turn.

### Strengths and Limitations

One strength of this study was the unique opportunity to describe symptoms from real-world data when patients experienced their MI symptoms, as well as to compare the symptom descriptions from ongoing calls with questionnaires from the same patient using a mixed-methods design. In addition, data from questionnaires were collected within 24 hours after arrival at hospital, which minimizes the risk of recall bias. This study also has a few limitations. First, the data were collected from a single catchment area in Sweden, which may affect the transferability of the results to other populations. Another limitation is that, in contrast to interviews, in already collected data, such as audio-recorded calls, there is no opportunity for the researcher to ask probing questions, which can make some information difficult to analyze in more depth. This study included twice as many men as women and 24 of 30 were patients with STEMI, which may have affected the results. Previous research indicates that MI symptoms differ between women and men, with chest pain being less prevalent in women.<sup>24</sup> More research is needed in a larger population, especially those with non-STEMI. Finally, this was a secondary analysis of existing data where the data were not originally collected to address the specified research aim.

### CONCLUSION

In conclusion, this study found patients' symptom descriptions in calls to tele-nurses and symptoms reported in questionnaires within 24 hours after MI diagnosis to be comparable and convergent. Chest pain was the most common symptom described, often accompanied by radiating pain in the arm, cold sweat, and nausea. The study also extends the understanding of acute MI symptoms as shown by symptoms described in calls that were not captured in questionnaires, such as palpitations, sore muscles, feeling warm or feeling cold, headache, and diarrhea. In the education of tele-nurses, it is important to emphasize the broad symptom descriptors given by the patients and that some patients may have symptoms that do not fit the template in the computerized decision support system. It is therefore imperative to add open-ended questions as a complement in the consultation, to capture all the symptoms.

### Acknowledgments

We would like to express our sincere gratitude to the patients who participated in this study. We would also like to thank Professor Eva Swahn for her contribution as the principal investigator for the SymTime study.

### REFERENCES

1. Coventry LL, Schalkwyk JW, Thompson PL, Hawkins SA, Hegney DG. Myocardial infarction, patient decision delay and help-seeking behaviour: a thematic analysis. *J Clin Nurs*. 2017;26(13–14):1993–2005.
2. Kirchberger I, Heier M, Wende R, von Scheidt W, Meisinger C. The patient's interpretation of myocardial infarction symptoms and its role in the decision process to seek treatment: the MONICA/KORA myocardial infarction registry. *Clin Res Cardiol*. 2012;101(11):909–916.
3. Nymark C, Mattiasson AC, Henriksson P, Kiessling A. The turning point: from self-regulative illness behaviour to care-seeking in patients with an acute myocardial infarction. *J Clin Nurs*. 2009;18(23):3358–3365.
4. Ibanez B, James S, Agewall S, et al. 2017 ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: the Task Force for the Management of Acute Myocardial Infarction in Patients Presenting With ST-Segment Elevation of the European Society of Cardiology (ESC). *Eur Heart J*. 2018;39(2):119–177.
5. Koul S, Andell P, Martinsson A, et al. Delay from first medical contact to primary PCI and all-cause mortality: a nationwide study of patients with ST-elevation myocardial infarction. *J Am Heart Assoc*. 2014;3(2):e000486.
6. Thylen I, Ericsson M, Hellstrom Angerud K, Isaksson RM, Sederholm Lawesson S. First medical contact in patients with STEMI and its impact on time to diagnosis; an explorative cross-sectional study. *BMJ Open*. 2015;5(4):e007059.
7. Souza-Junior VD, Mendes IAC, Mazzo A, et al. Application of telenursing in nursing practice: an integrative literature review. *Appl Nurs Res*. 2016;29:254–260.
8. Eklöf P. 1177 Vårdguiden—Healthcare Guide 1177. 2015. <https://www.1177.se/om-1177-varldguiden/om-1177-varldguiden/About1177Vardguiden/>. Accessed August 19, 2021.

9. Nymark C, Henriksson P, Mattiasson AC, Saboonchi F, Kiessling A. Inability to act was associated with an extended delay prior to care-seeking, in patients with an acute myocardial infarction. *Eur J Cardiovasc Nurs.* 2019;18(6):512–520.
10. Angerud KH, Brulin C, Eliasson M, Naslund U, Hornsten A. The process of care-seeking for myocardial infarction among patients with diabetes. *J Cardiovasc Nurs.* 2015;30(5):E1–E8.
11. Nielsen S, Falk K, Gyberg A, Määttä S, Björck L. Experiences and actions during the decision making process among men with a first acute myocardial infarction. *J Cardiovasc Nurs.* 2015;30(4):332–339.
12. Mehta LS, Beckie TM, DeVon HA, et al. Acute myocardial infarction in women, a scientific statement from the American Heart Association. *Circulation.* 2016;133(9):916–947.
13. Thygesen K, Alpert JS, Jaffe AS, et al. Fourth universal definition of myocardial infarction (2018). *Eur Heart J.* 2019;40(3):237–269.
14. Mann DL, Zipes DP, Libby P, Bonow RO. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine.* 10th ed. India: Elsevier; 2014.
15. Collet J-P, Thiele H, Barbato E, et al. 2020 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: the Task Force for the Management of Acute Coronary Syndromes in Patients Presenting Without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). *Eur Heart J.* 2021;42:1289–1367. doi:10.1093/eurheartj/ehaa57.
16. Tuominen P. 1177 Vårdguiden. Hjärtinfarkt [1177 Healthcare Guide. Myocardial infarction]. 2019. <https://www.1177.se/Vasterbotten/sjukdomar-besvar/hjarta-och-blodkar/hjartbesvar-och-hjartfel/hjartinfarkt/>. Accessed January 15, 2020.
17. NIH TNH, Lung, and Blood Institute (NHLBI). Heart attack. 2020. <https://www.nhlbi.nih.gov/health-topics/heart-attack>. Accessed January 15, 2020.
18. Strömbäck U, Engström Å, Wälivaara BM. Realising the seriousness—the experience of suffering a second myocardial infarction: a qualitative study. *Intensive Crit Care Nurs.* 2019;51:1–6.
19. Sederholm Lawesson S, Isaksson RM, Ericsson M, Ängerud K, Thylén I. Gender disparities in first medical contact and delay in ST-elevation myocardial infarction: a prospective multicentre Swedish survey study. *BMJ Open.* 2018;8(5):e020211.
20. Kirchberger I, Heier M, Kuch B, Wende R, Meisinger C. Sex differences in patient-reported symptoms associated with myocardial infarction (from the population-based MONICA/KORA Myocardial Infarction Registry). *Am J Cardiol.* 2011;107(11):1585–1589.
21. DeVon HA, Ryan CJ, Zerwic JJ. Is the medical record an accurate reflection of patients' symptoms during acute myocardial infarction? *West J Nurs Res.* 2004;26(5):547–560.
22. DeVon HA, Burke LA, Vuckovic KM, et al. Symptoms suggestive of acute coronary syndrome: when is sex important? *J Cardiovasc Nurs.* 2017;32(4):383–392.
23. Creswell JW, Clark VLP. *Designing and Conducting Mixed Methods Research.* Los Angeles: SAGE Publications; 2017.
24. Sederholm Lawesson S, Isaksson RM, Thylén I, Ericsson M, Angerud K, Swahn E, SymTime Study Group. Gender differences in symptom presentation of ST-elevation myocardial infarction—an observational multicenter survey study. *Int J Cardiol.* 2018;264:7–11.
25. Ericsson M, Angerud KH, Brannstrom M, Lawesson SS, Stromberg A, Thylén I. Interaction between tele-nurses and callers with an evolving myocardial infarction: consequences for level of directed care. *Eur J Cardiovasc Nurs.* 2019;18:545–553.
26. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA.* 2013;310(20):2191–2194.
27. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res.* 2005;15(9):1277–1288.
28. Graneheim UH, Lindgren BM, Lundman B. Methodological challenges in qualitative content analysis: a discussion paper. *Nurse Educ Today.* 2017;56:29–34.
29. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today.* 2004;24(2):105–112.
30. Abed MA, Ali RM, Abu Ras MM, Hamdallah FO, Khalil AA, Moser DK. Symptoms of acute myocardial infarction: a correlational study of the discrepancy between patients' expectations and experiences. *Int J Nurs Stud.* 2015;52(10):1591–1599.
31. Strömbäck U, Engström Å, Lundqvist R, Lundblad D, Vikman I. The second myocardial infarction: is there any difference in symptoms and prehospital delay compared to the first myocardial infarction? *Eur J Cardiovasc Nurs.* 2018;17(7):652–659.
32. Berg J, Björck L, Dudas K, Lappas G, Rosengren A. Symptoms of a first acute myocardial infarction in women and men. *Gen Med.* 2009;6(3):454–462.
33. DeVon HA, Ryan CJ, Rankin SH, Cooper BA. Classifying subgroups of patients with symptoms of acute coronary syndromes: a cluster analysis. *Res Nurs Health.* 2010;33(5):386–397.
34. Davis LL, McCoy TP, Riegel B, et al. Congruence of the medical record and subject interview on time of symptom onset in patients diagnosed with acute coronary syndrome. *Dimens Crit Care Nurs.* 2016;35(6):332–338.
35. Wibring K, Herlitz J, Lingman M, Bång A. Symptom description in patients with chest pain—a qualitative analysis of emergency medical calls involving high-risk conditions. *J Clin Nurs.* 2019;28(15–16):2844–2857.
36. Holmberg M, Andersson H, Winge K, et al. Association between the reported intensity of an acute symptom at first prehospital assessment and the subsequent outcome: a study on patients with acute chest pain and presumed acute coronary syndrome. *BMC Cardiovasc Disord.* 2018;18(1):216.
37. O'Donnell S, McKee G, Mooney M, O'Brien F, Moser DK. Slow-onset and fast-onset symptom presentations in acute coronary syndrome (ACS): new perspectives on prehospital delay in patients with ACS. *J Emerg Med.* 2014;46(4):507–515.
38. Gamst-Jensen H, Lippert FK, Egerod I. Under-triage in telephone consultation is related to non-normative symptom description and interpersonal communication: a mixed methods study. *Scand J Trauma Resusc Emerg Med.* 2017;25(1):52.
39. Röing M, Rosenqvist U, Holmström IK. Threats to patient safety in telenursing as revealed in Swedish telenurses' reflections on their dialogues. *Scand J Caring Sci.* 2013;27(4):969–976.
40. Ernesater A, Engstrom M, Winblad U, Holmstrom IK. A comparison of calls subjected to a malpractice claim versus 'normal calls' within the Swedish healthcare direct: a case-control study. *BMJ Open.* 2014;4(10):e005961.
41. Baxter SK, Allmark P. Reducing the time-lag between onset of chest pain and seeking professional medical help: a theory-based review. *BMC Med Res Methodol.* 2013;13:15.