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# Which health-related reasons lead to prehospital emergency care and how does subjective emergency status connect to subsequent care?

## Emergency medical service patients' survey linked to health claims data

### Supplementary Information

The online version of this article (<https://doi.org/10.1007/s10049-020-00832-2>) contains further tables. Article and additional material are available at [www.springermedizin.de](http://www.springermedizin.de). Please enter the title of the article in the search field. You will find the additional material under "Supplementary Material" in the article.



### Background

In Germany the rate of emergency medical services (EMS) cases increases steadily each year [1–3]—a trend that is also seen in many other countries (e.g. [4–6]). At the same time, the percentage of life-threatening complaints among all cases of prehospital emergency care decreased over time [7–9]. The majority of the EMS' "emergency care" do not cover tracer diagnoses or

life-threatening conditions [8, 10, 11]. In many countries EMS contribute to avoidable overcrowding of emergency departments, which may lower quality of care for patients with more severe needs [12–14]. It is unknown how increasing EMS use affects the quality of prehospital care. An increase in overall costs is an evident result. Patients insured in one of the compulsory German health insurance companies normally pay 10€ per EMS use out-of-pocket. Similar to many other countries, German patients largely decide for themselves when they choose emergency care and which type [15] (e.g. outpatient emergency services, emergency departments, EMS).

Facing the increasing EMS use, many countries deliberate on measures to

- decrease the number to medically/urgently needed cases (e.g. by referring non-acute cases to other professional help-systems),
- optimize disposition (e.g. those of emergency physicians or trying different, more prevention-oriented visits by paramedics),
- increase on-site care without transports or

- choose transport targets other than hospitals.

Yet, to develop measures that are sound and accepted/supported by the public, it is important to assess

- which health-related reasons and emergency status as perceived by the patients lead to prehospital emergency care and
- how they correspond to subsequent care and diagnoses.

As there are only very few international studies and no German study covering the EMS patients' perspective, we asked users about their motives and the circumstances that triggered the utilization. This paper focuses on the health-related

### Treten Sie in den Austausch

Diese Arbeit wurde für *Notfall+Rettungsmedizin* in Englisch eingereicht und angenommen. Wenn Sie über die deutsche Zusammenfassung hinaus Fragen haben und mehr wissen wollen, nehmen Sie gern in Deutsch über die Korrespondenzadresse am Ende des Beitrags Kontakt auf. Die Autor\*innen freuen sich auf den Austausch mit Ihnen.

reasons. German EMS can provide emergency care and non-emergency transports. The paper focuses on the first.

## Methods

The patient survey is part of the mixed-methods project “Integrated emergency care: A focus on emergency medical services” (acronym “Inno\_RD”; 01 April 2018–31 December 2020; more information on the broader research endeavor available at <http://rettungsdienst-im-fokus.ovgu.de>). The German Innovation Fund of the Joint Federal Committee (G-BA) funds the project (grant number 01VSF17032). As there was no standardized instrument, we developed a questionnaire with a focus on perceived health and motives/reasons for EMS use (translated questionnaire see [16]). We developed the questions based on Andersen’s Model of Health Services Use [17], which we complemented for emergency medical services [16].

The present paper focuses on the following key questions:

- Why would people call an ambulance for themselves and others (given the same hypothetical scenario)?
- Which self-perceived health conditions led to the real index prehospital emergency care?
- How do subjective health conditions compare to diagnoses in the health claims data?
- How does subjective emergency status relate to subsequent care?

Questions on the medical indications/circumstances for the past usage of EMS draw on the so-called “Notarztindikationskatalog” (NAIK; catalog of indications for emergency physicians) [18]. We translated the items of the NAIK to widely understood lay terms, if necessary.

Subsequently to a pretest ( $n=43$ ), we collected survey data in the time-span October 16 until December 2, 2018. Four German statutory health insurance companies (BMW BKK, Schwenninger BKK, BKK VerbundPlus, Bosch BKK) sent out the questionnaire to 1312 of their insured individuals. Selection criteria were:

## Insured individuals

- had EMS use including vehicles that indicate an *emergency* (including ground and aerial prehospital care; in German: “Notarztwagen”, “Notarzteinsatzfahrzeug”, “Rettungswagen” or “Primärtransport – Luft”) in the year 2016,
- operated by the German Red Cross,
- in selected “model regions” within the federal states of Bavaria and Baden-Wuerttemberg and
- were at least 18 years old and lived in Germany at the date of the survey.

We excluded patients who had non-emergency medical transports, died, lived abroad (on the start date of the survey) and those who had quit their health insurance company since their last (index) EMS use in the year 2016. The specific selection was due to the broader aim of the research project to match the patients’ survey response with data of their health insurance and of their respective EMS provider in specific “model regions”. In Germany, dispatch centers are obliged to choose the EMS provider that is closest to the site of emergency. The Red Cross covers most of the EMS care in the two chosen federal states.

We could link respondents’ questionnaires to selected variables of their pseudonymized health claims data. Data linkage relied on the individual, pseudonymized health insurance code (similar to a social security number). We asked patients to recall their (last) EMS use in the year 2016. We coded information on inpatient care accompanying EMS use if the patient was admitted to hospital the same day. According to the German coding rules, patients usually receive one principal primary diagnosis for their complete hospital stay. The principal diagnosis is supposed to be based on the main reason for the patient’s stay. More diagnoses per case might be coded if two different remuneration systems apply (e.g. treatment in psychiatry and trauma surgery) [19].

The insurance companies did not send any reminder, nor did they give incentives for participation. To increase trust, patients had to send the

pseudonymized questionnaire to the University of Magdeburg. The response rate was 20% ( $n=259$ ). As we accepted a filling rate of  $\geq 50\%$  for the quantitative sections, 254 out of 259 responses were used.

To identify diagnoses typical for EMS users, we compared our respondents’ principal diagnoses to

- official statistics on all inpatient diagnoses in German hospitals in 2016 (including non-EMS patients; based on [19]) and
- EMS users of six health insurance companies (BMW BKK, Schwenninger BKK, BKK VerbundPlus, Bosch BKK, BKK BKK Pfalz and mhplus), excluding those 1312 EMS users contacted as part of the patient survey.

The latter comparison group includes patients whose EMS case involved a vehicle indicating an emergency. We report their inpatient diagnoses belonging to the hospital stay starting on the same day as their last EMS use in 2016.

EMS patients’ age based on the year of EMS use (2016) minus year of birth; federal state based on the site of residency during the EMS use.

The survey data were keyed in manually and double-checked by a second party. We conducted descriptive and inferential analysis with IBM® SPSS® Statistics Version 25 (IBM Corporation, Armonk, NY, USA) and Microsoft Excel 2016 using pairwise deletion. For subgroup analyses, we calculated independent samples t-tests with Cohen’s  $d$  effect size and Fisher’s exact test, calculating Cramér’s  $V$  as effect-size. For tests on correlations, we calculated Pearson’s correlation coefficient. We accepted an  $\alpha$  of  $\leq 5\%$ . To test associations, age and length of inpatient stays were calculated as metrics (years; days), whereas all other variables based on percentages.

All respondents gave fully informed consent to the linkage and storage of their data. State Data Protection Commissioners of Bavaria, Baden-Wuerttemberg and Saxony-Anhalt, the Data Protection Officers of the respective health insurance funds and the Board of Medical Ethics of Magdeburg University (65/18) approved

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## Which health-related reasons lead to prehospital emergency care and how does subjective emergency status connect to subsequent care? Emergency medical service patients' survey linked to health claims data

### Abstract

**Objectives/Background.** In many countries, the use of emergency medical services (EMS) increases steadily each year. At the same time, the percentage of life-threatening complaints decreases. To redesign the system, an assessment and consideration of the patients' perspectives is helpful.

**Methods.** We conducted a paper-based survey of German EMS patients who had at least one case of prehospital emergency care in 2016. Four health insurance companies sent out the questionnaire to 1312 insured persons. We linked the self-reported data of 254 respondents to corresponding claims data provided by their health insurance companies. The analysis focuses a.) how strongly patients tend to call EMS for themselves and others given different health-related scenarios, b.) self-perceived health complaints in their

own index case of prehospital emergency care and c.) subjective emergency status in combination with so-called "objective" characteristics of subsequent EMS and inpatient care. We report principal diagnoses of (1) respondents, (2) 57,240 EMS users who are not part of the survey and (3) all 20,063,689 inpatients in German hospitals. Diagnoses for group 1 and 2 only cover the inpatient stay that started on the day of the last EMS use in 2016.

**Results.** According to the survey, the threshold to call an ambulance is lower for someone else than for oneself. In 89% of all cases during their own EMS use, a third party called the ambulance. The most common, self-reported complaints were pain (38%), problems with heart and circulation (32%), and loss of consciousness (17%). The majority

of respondents indicated that their EMS use was due to an emergency (89%). We could detect no or only weak associations between patients' subjective urgency and different items for objective care.

**Conclusion.** Dispatchers can possibly optimize or reduce the disposition of EMS staff and vehicles if they spoke directly to the patients more often. Nonetheless, there is need for further research on how strongly the patients' perceived urgency may affect the disposition, rapidness of the service and transport targets.

### Keywords

Emergency medical dispatcher · Transportation of patients · Ambulance · Respondent · Questionnaire

## Welche gesundheitlichen Gründe führen zur präklinischen Notfallversorgung und in welcher Verbindung steht die subjektive Notfalleinschätzung mit der sich anschließenden Versorgung? Befragung von Patient\*innen des Rettungsdienstes verknüpft mit Krankenkassendaten

### Zusammenfassung

**Zielsetzung/Hintergrund.** In vielen Ländern weltweit steigt die Anzahl der Rettungsdienst(RD)-Einsätze pro Jahr. Zugleich sinkt der Anteil der Einsätze mit lebensbedrohlichen Beschwerden. Für die Optimierung des Systems sind eine Bestandsaufnahme und der Einbezug der Patient\*innenperspektive hilfreich.

**Methode.** Es wurde eine papierbasierte Befragung von RD-Patient\*innen durchgeführt, die im Jahr 2016 mindestens in einem Notfalleinsatz versorgt wurden. Vier gesetzliche Krankenkassen versandten den Fragebogen an 1312 Versicherte. Die Befragungsdaten von 254 Patient\*innen wurden mit den dazugehörigen Krankenkassendaten verknüpft. Die Analyse fokussiert, a.) wie häufig Patient\*innen in gesundheitsbezogenen Szenarien für sich selbst oder für andere den RD rufen würden, b.) auf selbst wahrgenommene gesundheitliche Beschwerden beim eigenen

Index-Notfalleinsatz und c.) die subjektive Notfalleinschätzung in Verknüpfung mit „objektiven“ Merkmalen der rettungsdienstlichen und stationären Versorgung. Zudem werden die Hauptdiagnosen 1.) der Befragten, 2.) von 57.240 RD-Patient\*innen, die nicht im Rahmen der Befragung angeschrieben wurden, und 3.) von 20.063.689 stationären Patient\*innen in deutschen Krankenhäusern berichtet. Die Diagnosen von Gruppe 1 und 2 beziehen sich nur auf den stationären Krankenhausaufenthalt, der am Tag der letzten RD-Nutzung des Jahres 2016 begann.

**Ergebnisse.** Die Hemmschwelle der Befragten, den RD zu rufen, war niedriger für Dritte als für sich selbst. In 89% der Fälle mit eigener RD-Versorgung hatten andere den RD gerufen. Die häufigsten selbst berichteten Beschwerden waren Schmerzen (38%), Herz-Kreislauf-Probleme (32%) und der Verlust des Bewusstseins (17%). Die Mehrheit der Befragten äußerte, dass ihr RD-Einsatz durch

das Vorliegen eines Notfalls bedingt war (89%). Es ließen sich keine oder nur schwache Zusammenhänge zwischen der subjektiven Notfalleinschätzung und verschiedenen Merkmalen der objektiven Versorgung feststellen.

**Schlussfolgerung.** Es besteht die Chance, dass Leitstellenmitarbeiter\*innen die Einsatzdisposition optimieren oder reduzieren, wenn sie öfter mit den Patient\*innen selbst sprechen. In kommenden Studien muss untersucht werden, wie stark die von den Patient\*innen selbst wahrgenommene Dringlichkeit die Disposition, die Schnelligkeit der Versorgung und die Auswahl des Versorgungsziels beeinflussen sollte.

### Schlüsselwörter

Leitstellendisponent · Patiententransport · Krankenwagen · Befragter · Fragebogen

**Table 1** Overview of the sample characteristics (study population vs. German population)

	Included respondents (EMS patients only; <i>n</i> = 254)	Insureds of six health insurance companies (EMS patients only; <i>n</i> = 57,240)	German population (overall; <i>n</i> = 82.5 million)
Gender (%)	♂ 50.4%; ♀ 49.2%	♂ 52.8%; ♀ 47.2%	♂ 49.3%; ♀ 50.7%
Age	$\bar{x}$ : 55.6 (SD: 20.54); Median: 58 (IQR: 39; 72) Min: 16; Max: 93	$\bar{x}$ : 50.07 (SD: 24.52); Median: 52 (IQR: 30; 70); Min: 0, Max: 106	$\bar{x}$ : 44.3; Median: 45; Min: 0, Max: 90+ (SD and IQR unknown)
Federal state (residency)	60% Bavaria; 36% Baden-Wuerttemberg; 3% others; 1% none <sup>a</sup>	26% Baden-Wuerttemberg, 24% Bavaria; 49% others; 1% none	16% Bavaria; 13% Baden-Wuerttemberg; 71% others
Nationality	91.7% German; 8.3% others	92.0% German; 8.0% others; 0.04% unknown	88.8% German; 11.2% others

$\bar{x}$  mean, *SD* standard deviation, *IQR* interquartile range, *Min* minimum, *Max* maximum

<sup>a</sup>1 person missing postal code; 1 person lived outside of Germany; 1 person has an undefined postal code for site of residence, yet the additional variable called "KV-Wohnort" stands for "Bavaria"

of consent forms and data protection procedures.

## Sample

According to their health claims data, the respondents had the characteristics displayed in **Table 1**. One person lacked that information, except age. As there are no official statistics available for all EMS users in Germany, included respondents are compared to the general population [20] and to all EMS users insured by six cooperating health insurance companies in the year 2016.

Respondents with information on a state-specific 4-digit postal code of the site of emergency/collection location during their index EMS use (37% of all respondents, *n* = 95) received prehospital emergency care in 12 out of 16 German federal states; most commonly in Saxony (12.6%), Baden-Württemberg (5.1%) and Rhineland-Palatinate (4.7% of all cases).

At the point of the query, respondents (*n* = 238) answered to have had up to 40 EMS uses during their life (mean 2.79 ± 3.51 standard deviation [SD]; median and mode: 2).

To include severely ill or handicapped people, we had encouraged proxy respondents to fill out the questionnaire. Overall, 86% filled out the questionnaire themselves; 11% had provided the answers themselves, but someone else recorded them; in 3% of the cases someone else gave the answers.

## Results

### Probability to call EMS for others and themselves

Patients answered about different scenarios whether they would (= "yes"), would not (= "no") or "maybe/in individual cases" call an emergency medical service

1. for themselves or
2. for someone else.

We included answers if respondents answered the scenario for both groups (#1 and #2) or if the scenarios applied only in terms of calling an ambulance for someone else ("loss of consciousness" and "suicide"). The scenario of oneself being in labor is reported for female respondents only.

The majority of respondents would call an ambulance if someone else (96%) or they themselves (91%) lost a lot of blood (**Fig. 1**). Having symptoms of a flu for three days that worsen despite sufficient sleep, led to the least amount of people calling an ambulance for others (11%) or themselves (8%). The category "maybe/in individual cases" was most frequent for the scenario that someone else would twist one's ankle during a walk or doing sports (46%). People would rather call EMS for someone else than themselves (with a medium effect for blood loss [*n* = 247; *p* < 0.001; Cramér's *V* = 0.48]; high effect for all other comparable items [*V* ≥ 0.70 for each association]).

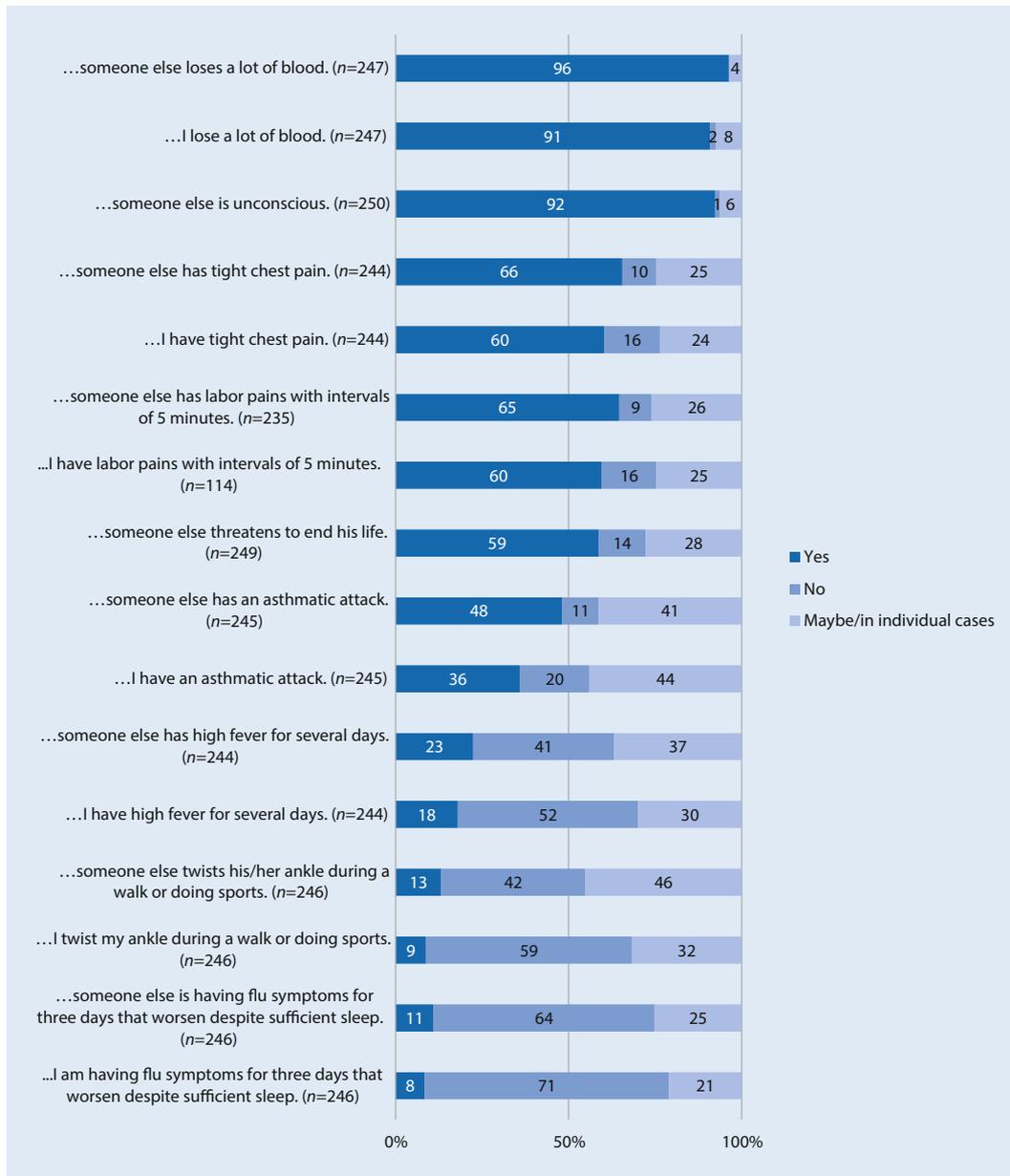
In the respondents' own real index EMS use (*n* = 251), 89.2% of the respondents stated that at least one third party called the ambulance. In 12% of the cases,

a doctor saw the medical need for prehospital emergency care (**Fig. 2**). If people explained why they checked "other persons", these were third parties, except in one case when the EMS was already present.

### Self-perceived complaints and inpatient ICD diagnosis

In their specific EMS use, respondents reported to have had an average of 2.2 complaints (max: 9 complaints per person; *n* = 253). The most common complaints were pain (37.9%) and problems with heart and circulation (32.0%; **Fig. 3**). Among 44 persons checking the free text field "other", 40 provided further explanations: About half of these can be defined as "detailed information on items already contained in the questionnaire". The other half gives hints that the respondents especially missed the options "dizziness" (*n* = 7) and "amnesia" (*n* = 3).

According to the health claims data, 173 patients (68.1% of all respondents) received inpatient hospital care on the same date as their EMS use. **Table 2** displays the most common inpatient diagnoses for our respondents compared to official statistics on all patients receiving inpatient care in German hospitals and EMS users of those six cooperating health insurance companies. Diseases of the circulatory system and injuries/poisoning/external causes are leading ICD (International Classification of Diseases) chapters for all three compared groups. The comparably high amount of cases with "symptoms, signs and abnormal clinical and laboratory findings, not elsewhere



**Fig. 1** ◀ Answers on the task “From your point of view, what is a reason to call an ambulance, either for you or for someone else? Please imagine the following situations” (sorted by scenario with decreasing amounts of consent)

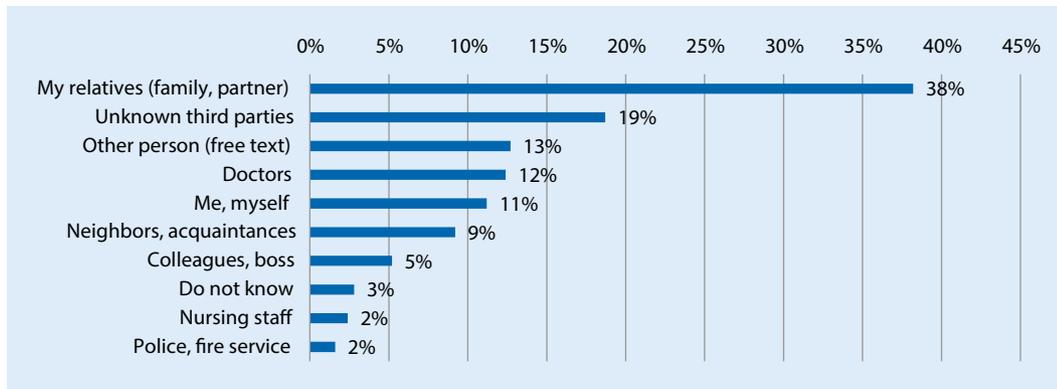
classified” (R-Codes) is especially common for EMS patients, not for all inpatients in German hospitals.

■ **Figure 4** displays respondents with the two most frequent inpatient principal diagnoses and their corresponding self-perceived complaints. About half of the EMS patients with an ICD diagnosis of chapter “injuries/poisoning/external cause” (chapter S/T) report pain and/or bone fracture. Of all EMS patients with diagnosed diseases of the circulatory system (chapter I) 50% state problems with heart/circulation. *Supplementary Information 1* offers results

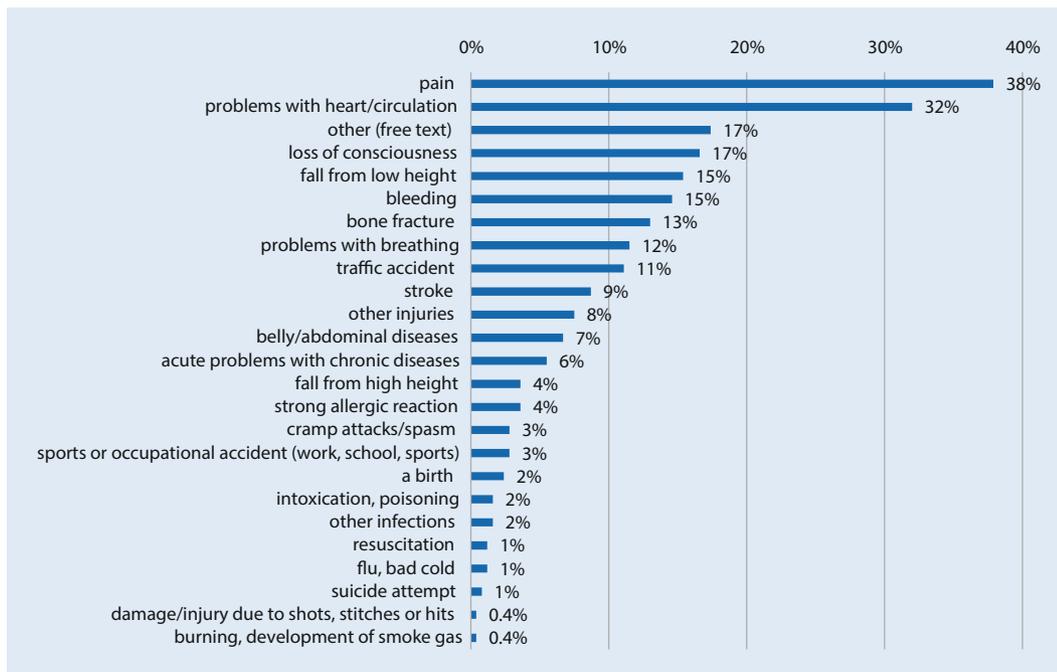
on significance tests for self-reported complaints stated by inpatients with ICD chapters “S/T” or “I” compared to other inpatients and compared to all respondents. One exemplary result is that respondents with an ICD chapter “diseases of the circulatory system” have significantly more often checked “problems with heart/circulation” than those with ICD chapters for “injuries/poisoning/external cause” (50% versus 15%;  $p = 0.001$ ;  $V = 0.38$ ).

### Association of subjective need and urgency with indicators of objective need

With the question “How urgently did you need the following from the rescue personnel (e.g. paramedics, emergency physicians)...?”, we focused on EMS’ core competencies (■ **Fig. 5**). Over all items, at least 73.9% checked “1” or “2” of the 5-point scale, indicating a high urgency. At least every tenth person (10.2%) checked “4” or “5”, equaling no or little urgency to receive any of the services.



**Fig. 2** ◀ Percentages for answering affirmative to the question “Who called the emergency medical service in that case of pre-hospital emergency care?” (Multiple answers allowed;  $n = 251$ ; items in decreasing order)



**Fig. 3** ◀ Percentage of respondents confirming the items of the question “Back then, what was/were the reason(s) for using the emergency medical services from your perspective?” (Multiple answers allowed.) ( $n = 253$  respondents; items in descending order)

The respondents also answered on: “In retrospect, how would you judge your prehospital emergency care?” ( $n = 248$ ). On the scale, only the endpoints “1” = “no emergency case” and “5” = “extreme emergency” were labeled, along with the sixth option “don’t know” (which 4.4% used). About every third person (31.5%) judged his/her case as extremely urgent (checking “5”), while 11.3% checked the two lowest options (“1” and “2”) for little or no emergency.

When asked “Why else did you use the emergency medical service?”, 11.0% denied an emergency as a reason for EMS use in their index case. We split the respondents into two groups, #1 group negating an emergency versus #2 group affirming an emergency as a reason. The

amount of women in group #1 is significantly higher than in group #2 (16.5% versus 5.4%), but only a small effect could be measured (Cramér’s  $V = 0.18$ ;  $p = 0.01$ ;  $n = 226$ ). Group #1 comprises younger patients (mean age: 48 in group #1 versus 56 in group #2; Cohen’s  $d = 0.42$ ;  $p = 0.05$ ).

We further estimated the association between subjective emergency (group #1 or #2) and indicators for (possible) objective need (“objective” as defined by experts and found in the health claims data). There is *no* statistically significant association that patients who affirmed an emergency as a reason would

- be more likely to be transported by a vehicle manned with an emergency

physician (Cramér’s  $V = 0.02$ ,  $p = 0.83$ ;  $n = 227$ ),

- be more likely to receive inpatient care on the date of their EMS use (Cramér’s  $V = 0.09$ ,  $p = 0.18$ ;  $n = 227$ ) or
- have longer stays of inpatient care

than those denying an emergency as a reason. The association between subjective emergency and the length of inpatient stay is neither significant for patients with regular discharge (e.g. patients going home or to nursing homes; Cohen’s  $d = 0.32$ ;  $p = 0.26$ ,  $n = 145$ ) nor for all patients (including “discharges” due to hospital deaths; Cohen’s  $d = 0.30$ ;  $p = 0.29$ ;  $n = 154$ ).

**Table 2** Most common principal diagnoses of respondents with inpatient care ( $n = 173$  patients), EMS inpatients not contacted for survey purposes ( $n = 32,766$ ) and all inpatients in German hospitals ( $n = 20,063,689$ ; cf [19]) in the year 2016

Diagnoses of respondents ( $n = 173$ EMS inpatients)		Diagnoses of insureds of six health insurance companies ( $n = 32,766$ EMS inpatients)		Diagnoses of all patients in German hospi- tals ( $n = 20,063,689$ inpatients)	
Code	Percentage of all diagnoses ( $n = 177$ )	Code	Percentage of all diagnoses ( $n = 33,715$ )	Code	Percentage of all diagnoses ( $n = 20,063,689$ )
<b>ICD chapters (top 3)</b>					
Injuries, poisoning and certain other consequences of external causes (S/T)	27.1	Injuries, poisoning and certain other consequences of external causes (S/T)	21.3	Diseases of the circulatory system (I)	14.6
Diseases of the circulatory system (I)	25.4	Diseases of the circulatory system (I)	19.6	Injuries, poisoning and certain other consequences of external causes (S/T)	9.9
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R)	11.3	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R)	10.3	Diseases of the digestive system (K)	9.8
<b>ICD (3-digits; top 3)</b>					
Acute myocardial infarction (I21)	5.6	Intracranial injury (S06)	4.3	Liveborn infants according to place of birth (Z38)	2.8
Cerebral infarction; Syncope and collapse; Intracranial injury (I63, R55, S06)	5.1 each	Acute myocardial infarction (I21)	3.6	Congestive heart failure (I50)	2.3
Pain in throat and chest (R07)	4.0	Cerebral infarction (I63)	3.5	Mental and behavioral disorders due to use of alcohol (F10)	1.6

EMS emergency medical services, ICD International Classification of Diseases

We also calculated the association between those items for “objective” need and the self-perceived emergency status reported on the 5-point scale for the question “In retrospect, how would you judge your prehospital emergency care?” On the subjective urgency scale, the mean for patients transported by a vehicle manned with an emergency physician does *not* significantly differ from those without such vehicles ( $p = 0.08$ ;  $n = 237$ ). Yet, respondents receiving inpatient care on the date of their EMS use have slightly higher means (i.e. slightly higher self-perceived urgency;  $p < 0.001$ ; mean 4.07, standard deviation [SD] 1.02 for inpatients versus mean 3.42, SD 1.11 for those without inpatient care). There is a significant, yet small correlation between urgency rating and length of inpatient stay: This applies to patients with all types of discharges ( $r = 0.27$ ;  $p = 0.001$ ;  $n = 159$ ) and those with regular discharge ( $r = 0.28$ ;  $p = 0.001$ ;  $n = 150$ ). Since 95% of the respondents stated a transport to the hospital (which may result in ambulatory or inpatient care), we cannot evaluate the association between self-perceived

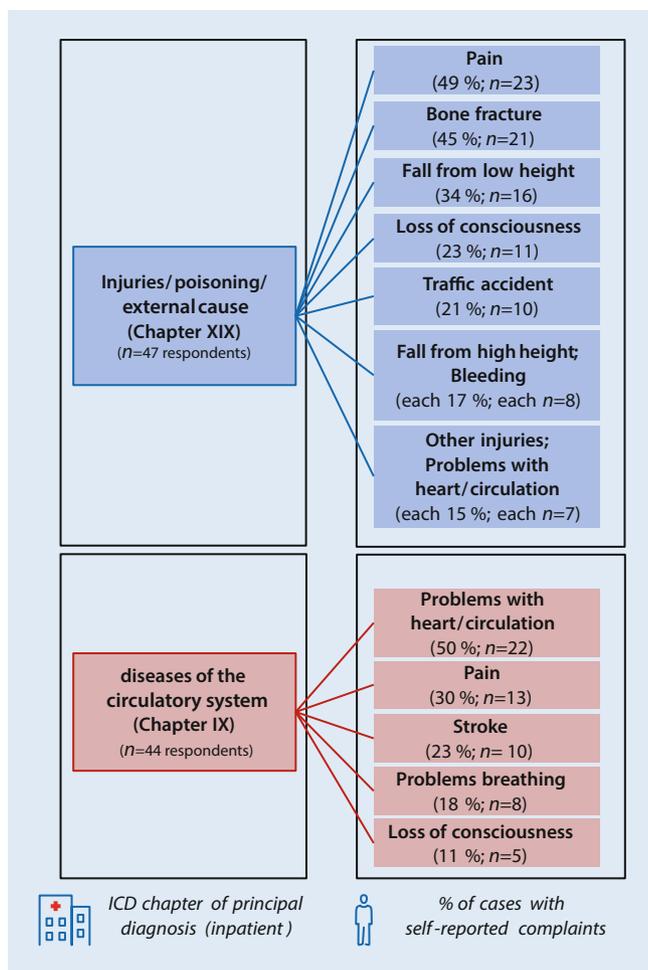
(non)emergency and transport targets or care on site exclusively.

## Discussion

For some urgent complaints, such as losing a lot of blood, almost every respondent would call an ambulance. There seems to be a need for health education to decrease EMS use (e.g. in uncomplicated cases of labor pain) or to increase it (e.g. in cases with heart attack symptoms). Surveys in other countries/continents (like U.S. [21] and Europe [22]) also show a need for better health literacy on heart attack symptoms and on the necessity to call EMS in such cases. Nonetheless, studies on health literacy are very prone to methodical effects (e.g. potential overestimation of knowledge if respondents have to choose from listed heart attack symptoms, cf. [23]). A Japanese study with a scenario on twisting one’s own ankle received comparable percentages for calling EMS (12% in Japan versus 9% in our study) [24].

Our results suggest that every tenth patient did not assess him-/herself as an

emergency or any of the EMS providers’ key services as urgent. Studies using professionals’ assessments show higher percentages of low-acuity or non-emergent cases (e.g. in Germany [11] or Great Britain [7]). As, in the scenarios, the threshold to call an ambulance for someone else is lower than for oneself and, in real life, most calls are done by third parties, there could be a chance to increase the quality of the disposition or referrals if dispatchers spoke with the patient more often. This is supported by the finding that diagnosed ICD chapters and self-perceived complaints correspond well. Comparing the inpatient diagnosis to self-perceived complaints, it seems reasonable that the respondents stated problems with heart/circulation (apart from the unspecific complaint “pain”) as leading causes. As the NAIK offers many complaints or circumstances that fit to the common ICD chapter “injuries/poisoning/external cause”, one can estimate that there is also a high amount of self-perceived injuries. German claims data do not record the date a specific diagnosis was given in the ambulatory



**Fig. 4** ◀ Respondents with the inpatient principal diagnoses “injuries/poisoning/external cause” ( $n = 47$ ) and “diseases of the circulatory system” ( $n = 44$  patients) and their corresponding self-reported core complaints (multiple checks allowed); depicted are all self-reported complaints with  $n \geq 5$

setting, which makes it unmatchable with a specific EMS use. More detailed analyses on self-reported complaints versus coded diagnosis could be beneficial. Altogether, our comparisons reveal that—on the 3-digit ICD level—inpatient EMS users have a profile of higher urgency compared to all inpatients. At the same time, we cannot judge whether the higher percentage of EMS users’ unclear symptoms and findings (ICD chapter R) is an indicator for lower urgency or for the need to receive additional testing or follow-up after the hospital stay. There might still be a high urgency for assessments in those cases, if one considers the whole pathway to a diagnosis: For example, the final diagnosis “chest pain” (as part of the respondents’ frequent diagnosis R.07) can be an urgent reason for EMS use to preclude myocardial infarctions.

The varying results between two different items for subjective urgency

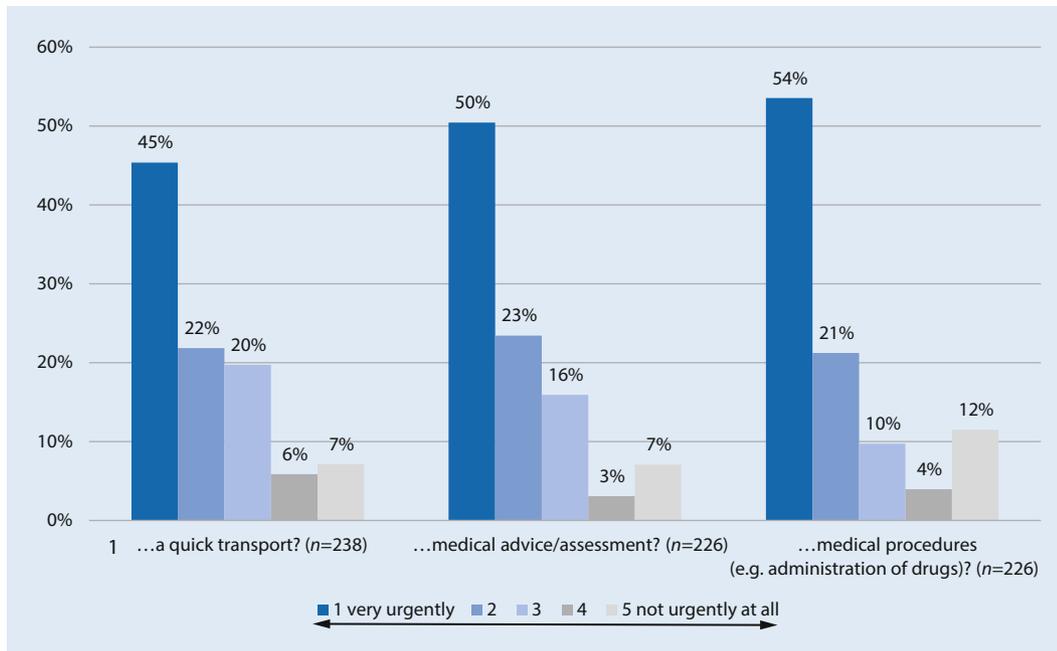
and their associations with “objective” demand reveal ambiguity. Whereas “(non)emergency as a reason for EMS use” lacked associations with objective demand, items for “urgency rated on a scale” revealed significant associations with *some* of the indicators for objective demand. Even though lack of significance may be due to small sample size, our measured effect sizes hint at small effects only. Correlations and mean differences were rather small, too. Independent from how subjective urgency was assessed (whether on a scale or whether emergency was stated as a *reason* for EMS use), subjective urgency and the disposition of emergency physicians seem not related to each other.

Altogether, the results on all associations tested may raise questions concerning the patients’ ability to assess the urgency of their own case. Yet, it could be that in Germany “inpatient stay” itself is not the best indicator for objective

need, as Germany’s hospital admission rate is third highest in Europe and also the rate of avoidable admissions is considered to be high [25]. Similarly, a “transport” itself and especially “transports to hospitals” seem to be inadequate objective indicators: Germany’s rate of EMS transports per case is higher than in other European countries [26, 27] and the U.S. [28]. Analysis of Bavarian dispatch data hint that about 20% of the patients are not transported to a hospital [29]. Schmiedel and Behrendt [2] estimated for Germany that 9% *without* and 6% of all prehospital emergency care cases *with* physicians are cases without transports, procedures or being cancelled prior to arrival. The fact that only 5% of our respondents did not receive transports to the hospital seems plausible, since most German EMS only receive reimbursements for cases that are accompanied or followed by physicians’ care (usually on site or in the hospital). Liability problems might further increase the number of transports, as it remains unsafe for paramedics to decide themselves not to transport and for dispatchers not to send any EMS staff. It could be beneficial to expand the research on the association between the subjective assessment and the objective need to evaluate how strongly the patient’s perceived urgency should or may affect the disposition, rapidness of the service and transport decisions. So far, missing or weak associations could be both due to patients’ poor self-assessment of emergencies or due to overcare affecting supposedly “objective” variables.

## Strengths and limitations

As there is no pre-existing instrument, our questionnaire could be a starting basis for further validations with larger sample sizes. Our pretest gave hints on positioning effect, e.g. that respondents probably check “pain” less frequently if it is in the lower third of the list of possible complaints. However, pain was also the most common or a comparably frequent complaint in other countries (like Japan [30] and USA [31, 32]). So far, the translated, extended NAIK seems feasible for questioning patients if complaints “dizziness” and “amnesia” are added.



**Fig. 5** ◀ Distribution of answers (percent) to the question “How urgently did you need the following from the rescue personnel (e.g. paramedics, emergency physicians)...?” on a 5-point scale “very urgently” to “not urgently at all”

The respondents show similar characteristics as those detected for our study population of 57,240 EMS patients, e.g. the same three most common chapters of inpatient principal diagnoses. Yet, one must take into account that both sources overrepresent residents of Bavaria and Baden-Wuerttemberg. Altogether, our respondents’ EMS use took place in at least 12 out of 16 German states. A study including 16 hospitals in the federal state Hessen also showed that the ICD chapters I, S/T and R cover the most frequent inpatient diagnoses for EMS patients [33]. Official reports using EMS data of Bavaria and Baden-Wuerttemberg lack information on health complaints/indications. In the only German-wide publication attempting to offer the medical reasons according to rescue data, the majority of the patients have indistinct “other emergencies” [19]. Thus, due to the innovative approach of our study, we cannot fully answer questions on its representativeness.

Limitations due to a response rate of 20% cannot be ruled out. In general, different studies reported lower response rates for Germany (e.g. compared to U.S. and Canada) and an international trend to decreasing response rates has been observed [34, 35]. Future studies could help to investigate whether changes on the general survey design and efforts in

fieldwork can increase the response rate or how the context of the country limits it (cf. [34]).

Our project “Inno\_RD” aimed to amalgamate patient survey responses with EMS data and health claims data covering at least one year after the index EMS use. Claims data are available for research with a further delay of about one year. Therefore, the respondents had to recall prehospital care that happened 2–3 years ago. As the respondents stated to have had a mean of 2.8 EMS uses per life and other studies show a good general recall of more salient, emotional experiences [36], there is a high plausibility that respondents can remember the index EMS use. The medical diagnoses in the health claims data in combination with the self-reported health reasons strengthen that impression. Nonetheless, future studies could benefit from interviewing closer to the actual prehospital emergency care, which would also include some of the medium-term fatal courses and could potentially reduce bias due to retrospective judgements.

As the EMS data acquired for the project “Inno\_RD” contained too few matchable cases and too many missings for relevant variables, we refrained from reporting data reported by paramedics, emergency physicians or dispatchers. Generally, this data may offer additional

insights on the association between subjective reasons and subsequent care. Germany would do well to establish the legal and technical prerequisite for comparable and matchable EMS data, across the borders of local rescue areas or federal states [37].

## Conclusion

In this study, diagnosed ICD chapters and self-perceived complaints correspond well. Every tenth EMS user does not consider him-/herself as an emergency. There is a chance that dispatchers could optimize or even avoid EMS cases if they spoke directly with the patient more often, instead of speaking with the third party calling. So far, we could not detect any or only weak associations between patients’ subjective urgency and different items for actual care. Further research on the association between subjective and objective care requirements could be beneficial. Altogether, matching pseudonymized survey and health claims data proved to be a useful approach to analyze EMS patients’ care and might in due course help to optimize it.

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## Compliance with ethical guidelines

**Conflict of interest.** S. Piedmont, A.K. Reinhold, J.-O. Bock, E. Swart and B.-P. Robra declare that they have no competing interests.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1975 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual respondents included in the study.

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