

# Chest pain in general practice: Frequency, management, and results of encounter

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## ABSTRACT

**Objective:** Chest pain is a common reason for an encounter in general practice. The present investigation was set out to characterize the consultation rate of chest pain, accompanying symptoms, frequency of diagnostic and therapeutic interventions, and results of the encounter. **Materials and Methods:** Cross-sectional data were collected from randomly selected patients in the German Sächsische Epidemiologische Studie in der Allgemeinmedizin 2 (SESAM 2) and analyzed from the Dutch Transition Project. **Results:** Overall, 270 patients from the SESAM 2 study consulted a general practitioner due to chest pain (3% of all consultations). Chest pain was more frequent in people aged over 45 years. The most common diagnostic interventions were physical examination, electrocardiogram at rest and analysis of blood parameters. For the majority of cases, the physicians arranged a follow-up consultation or prescribed drugs. The transition project documented 8117 patients reporting chest pain with a frequency of 44.5/1000 patient years (1.7% of all consultations). Physical examination was also the most common diagnostic intervention, and physician's advice the most relevant therapeutic one. **Conclusion:** The most common causes for chest pain were musculoskeletal problems followed by cardiovascular diseases. Ischemic heart disease, psychogenic problems, and respiratory diseases each account for about 10% of the cases. However, acutely dangerous causes are rare in general practice.

**Keywords:** Chest pain, frequency, general practice, reason for encounter

## Introduction

Chest pain is a common reason for an encounter in general practice.<sup>[1-7]</sup> Although in most cases the cause of chest pain is known to be a benign condition,<sup>[2-4,6]</sup> it is a challenge for general practitioners to identify an acutely dangerous cause, such as pulmonary embolism or acute coronary syndrome, but, on the other hand, to avoid unnecessary testing, referrals, and hospital admissions.<sup>[5,8,9]</sup> That is why chest pain raises grave concern in both patients and doctors.<sup>[7]</sup> A large amount of literature addresses the topic, but the majority focuses on underlying specific conditions or single diseases, such as chronic heart

disease, or the data collection is conducted in settings other than general practice.<sup>[3,10]</sup>

This study was planned to characterize the consultation rate, the interventions, the results of the encounter (“diagnoses”), and the significantly more frequent accompanying symptoms and associated results of the encounter of patients attending a typical German general practice setting. The registration of the contacts for chest pain was a minor part of the Sächsische Epidemiologische Studie in der Allgemeinmedizin 2 (SESAM 2) study. Data from the Dutch Transition Project,<sup>[11]</sup> a study with one of the largest patient samples in primary care, were also analyzed in detail with regard to chest pain as the reason for encounter.

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## Materials and Methods

### SESAM 2 study

In the course of the SESAM 2 study, the Saxon Society of General Medicine (SGAM) contacted all general practitioners in Saxony by mail. They received no incentive for their participation. The study was set out to document reasons for consultation, diagnostic, and therapeutic interventions as well as the result of consultation (chosen diagnosis). Of the 2510 physicians contacted, 270 general practitioners agreed to participate, and 209 cooperated during the complete period of the study (1 year). Cross-sectional data were collected from October 01, 1999 to September 30, 2000. Case recording was carried out on 1 day/week (Monday to Friday; either morning or afternoon consultation hours), randomly chosen. Data were collected for one out of ten patients of every practitioner (exactly every 10<sup>th</sup> patient attending the consultation hours). Multiple recordings of the same patient were avoided. House calls were not considered. A total of 8877 patients were included. A standardized paper-based data collection form was used.<sup>[12]</sup> It was developed by general practitioners (Leipzig Medical School and SGAM), tested, and evaluated during a pilot trial (Saxon Epidemiological Study in General Practice - SESAM 1). Each patient's reasons for encounter, accompanying symptoms, diagnostic interventions, and results of the encounter were documented, as well as therapeutic interventions. As far as possible, data were documented verbatim (according to the study instructions): Either as told by the patients (e.g., reasons for the encounter) or in the words of the physician (e.g., chronic problems, disease labels, results of encounter or diagnoses). Only fully completed forms were considered. As described elsewhere, the SESAM 2 study provides independent and unbiased cross-sectional data from a typical primary care setting.<sup>[13]</sup> Because all reasons for consulting were investigated and documented, there is no bias toward the investigated reason of encounter. The 1987 version of the International Classification of Primary Care (ICPC) was used to code the reasons for the consultation.<sup>[14]</sup> The SESAM 2 study was performed in accordance with the Declaration of Helsinki. It followed the guidelines of the Ethics Committee of the Saxon Chamber of Physicians who approved the design and the study. Since the data reported by the general practitioners did not allow the identification of single patients and since the study was unlikely to interfere with the treatment of patients or their physical or psychological integrity there was, according to the (model) Professional Code of Physicians in Germany, no further ethical approval was necessary.

### Transition project

The SESAM 2 data were compared with those of other studies. Publicly available data from the Dutch Transition Project (described by Lamberts and Okkes)<sup>[11,15]</sup> were analyzed (DTP; total estimation of patients from about 20 Dutch general practitioners; 1985–2003). The data are available on [www.transitionproject.nl](http://www.transitionproject.nl). Because chest pain is not represented by a single ICPC code, the codes K01 (pain attributed to

heart), K02 (pressure/tightness attributed to heart), K29 (other symptoms heart/circulatory system), L04 (chest symptoms/complaints), R01 (pain attributed to respiratory system), and have been summarized as “chest pain.”

### Data analysis

Statistical analyses of the data were performed using Statistical Packages for Social Sciences (SPSS version 15.0; SPSS Inc., Chicago, USA). As indicated, data were compared using Fisher's exact test. Differences were stated as statistically significant for  $P < 0.05$ .

## Results

### SESAM 2 study

A total of 8877 consultations were documented in the SESAM 2 study and 13,632 reasons for encounter were coded. Between 1999 and 2000, the number of cases reported from each general practitioner's office ranged from 23 to 54. There were 5050 (56.9%) female and 3824 (43.1%) male patients reported by 209 general practitioners; gender was not reported in three cases. Age ranged from 2 to 102 years (mean 51.2 years, standard deviation  $\pm$  20.9, median 55 years).

Overall, 270 patients were recorded as encountering “chest pain.” This equates to a frequency of 3.0% [Table 1 for age distribution]. At 39.3%, the age group 45–64 years accounted for the largest number of patients encountering chest pain. Of these, 152 (56.3%) were female, and 118 (43.7%) were male. The consultation frequencies showed no gender-related differences (data not shown). Furthermore, there were no seasonal differences (data not shown).

More than 50 different symptoms that accompanied chest pain were recorded. A few were statistically significantly associated with chest pain in the SESAM 2 study: Dyspnea (4.8% vs. 0.9%,  $P < 0.001$ ), accidents/injuries (0.4% vs. 0.1%,  $P = 0.001$ ), and palpitations (0.7% vs. 0.3%,  $P < 0.001$ ). Anxiety not other

**Table 1: The age-distribution of chest pain patients (ad) and the frequency of chest pain patients among all patients in percent of the respective age group (cp) in the German SESAM 2 study (total n=8877) and the DTP (total n=149,238)**

| Age (years) | SESAM 2 (n=270) |     | DTP (n=8117) |     |
|-------------|-----------------|-----|--------------|-----|
|             | ad              | cf  | ad           | cf  |
| 0-4         | 0               | 0   | 0.5          | 0.4 |
| 5-14        | 1.9             | 1.8 | 2.6          | 1.5 |
| 15-24       | 8.9             | 2.7 | 7.1          | 3.6 |
| 25-44       | 19.3            | 2.9 | 32.4         | 5.8 |
| 45-64       | 39.3            | 3.7 | 30.3         | 7.5 |
| 65-74       | 18.5            | 3.0 | 15.9         | 8.1 |
| >75         | 12.2            | 2.8 | 11.1         | 6.1 |

SESAM: Sächsische Epidemiologische Studie in der Allgemeinmedizin; DTP: Dutch Transition Project; ad: Age distribution; cp: Chest pain; cf: Consultation frequencies

specified (3.0% vs. 0.8%), fear of a heart disease or respiratory disease were also significantly associated (0.7% vs. 0.1% and 0.7% vs. 0.0%,  $P < 0.05$  for each) with chest pain.

Nearly, all patients were physically examined (92.6%). Various additional tests were performed for diagnosing chest pain. Table 2 summarizes the management of chest pain: Referrals were made for 11.1% and hospitalization for 4.1% of patients with chest pain. The most frequent medical treatments were follow-up consultation (75.6%) and drug prescription (67.4%).

Results of encounters (“diagnoses”) are summarized in Table 3. Thirteen results of encounter occurred significantly more often in patients consulting for chest pain.

### Transition project

A total of 149,238 patients were examined for the transition project from 1985 to 2003; 84,285 (56.5%) of them were female. In all, 8117 patients suffered from chest pain; 4333 (53.4%) were female patients. The frequencies were 39.1 for male and 41.5 for female patients per 1000 patient years. Among the total number of 597,312 encounters, there were 7220 (72.0%) consultations for new chest pain and 2814 (28.0%) consultations for previously known chest pain, respectively. This corresponds to a frequency of 1.7%. The age distribution of the patients is presented in Table 1.

Patients consulting for chest pain also suffered from a cough (3.3%), dyspnea (3.0%), and feared diseases of the circulatory system (2.8%). Furthermore, palpitations (1.2%), general weakness (1.1%), arm complaints (0.7%), accidents/injuries (0.7%), shoulder complaints (0.7%), back complaints (0.7%), fever (0.6%), and fear of heart attack (0.6%) were also common accompanying reasons for encounter in patients consulting for chest pain.

The recorded interventions for chest pain patients are summarized in Table 2.

In the Dutch Transition Project, general practitioners attributed chest pain most commonly to ischemic heart diseases, pulmonary diseases, and diseases of the musculoskeletal system [Table 3]. Possible life-threatening dangerous causes in 10,034 consultations with chest pain were: Pneumonia (0.8%), pulmonary embolism (0.2%), paroxysmal tachycardia (0.2%) and duodenal ulcer, other peptic ulcers, stroke/cerebrovascular insult, ruptured spleen, or toxemia (pre) eclampsia, with each accounting for <0.1%. Acute coronary syndrome, acute myocardial infarction, and unstable angina pectoris were classified as ischemic heart disease (10.0%); therefore, no explicit frequencies of these dangerous causes of chest pain can be provided. Other results of encounters that may have required further investigation included general heart failure and heart valve diseases, cardiac arrhythmias, and suspected (malignant) neoplasm.

**Table 2: Physician’s action (%) in the German SESAM 2 study and the DTP concerning the consultations for chest pain**

| Physician’s action         | SESAM 2 study (n=270) | DTP (n=10,034) |
|----------------------------|-----------------------|----------------|
| Physical examination       | 92.6                  | 104.2*         |
| Follow-up consultation     | 75.6                  | 28.0           |
| Drug prescription          | 67.4                  | 30.5           |
| EKG                        | 44.4                  | 6.9            |
| Incapacity to work         | 25.2                  | N/A            |
| Laboratory investigations  | 24.1                  | 6.2            |
| Physician’s advice         | 17.8                  | 39.9           |
| Other therapy              | 14.4                  | 1.6            |
| Physiotherapy              | 13.3                  | 1.9            |
| Referral                   | 11.1                  | 5.3            |
| Other diagnostics          | 7.8                   | 7.6            |
| Psychotherapy              | 4.4                   | 0.05           |
| Hospitalization            | 4.1                   | 2.3            |
| Exclusively taking history | 3.3                   | N/A            |
| Spirometry                 | 2.2                   | N/A            |
| Vaccination                | 2.2                   | 0.03           |

\*Resulting from 10,456 physical examinations in 10,034 consultations, thereby physical examinations regarding the musculoskeletal system (L31) in 38.7, the cardiovascular system (K31) in 30.9, the respiratory system (R31) in 18.5, unspecific problems (A31) in 5.7, the digestive system (D31) in 2.5, the psychological issues (P31) 1.1, the neurological (N31) 0.7, the skin (S31) 0.5% of the consultations. The remaining 1.4% of physical examinations was related to the ICPC-2 chapters Z, H, B, T, and F. SESAM: Sächsische Epidemiologische Studie in der Allgemeinmedizin; DTP: Dutch transition project; EKG: Electrocardiogram; N/A: Not available; ICPC: International Classification of Primary Care

**Table 3: Comparing the number (n) and percentage (%) of results of encounter (“diagnoses”) in general practice patients with chest pain to those without chest pain (SESAM 2 study)**

| Result of encounter*                       | With chest pain (n=270) n (%) | Without chest pain (n=8607) n (%) | P (Fisher) |
|--|-------------------------------|-----------------------------------|------------|
| Coronary heart disease                     | 39 (14.4)                     | 81 (0.9)                          | 0.001      |
| Disease of the nervous system              | 23 (8.5)                      | 135 (1.6)                         | 0.001      |
| Other disease circulation system           | 17 (6.3)                      | 101 (1.2)                         | 0.001      |
| Other disease or abnormal test results     | 17 (6.3)                      | 238 (2.8)                         | 0.002      |
| Other disease musculoskeletal system       | 12 (4.4)                      | 50 (0.6)                          | 0.001      |
| Neurologic and somatical disorder          | 11 (4.1)                      | 108 (1.3)                         | 0.001      |
| Cardiac conduction disorders               | 6 (2.2)                       | 64 (0.7)                          | 0.019      |
| Chronic obstructive pulmonary disease      | 6 (2.2)                       | 48 (0.6)                          | 0.006      |
| Heart failure                              | 5 (1.9)                       | 26 (0.3)                          | 0.002      |
| Health risk concerning transmitted disease | 5 (1.9)                       | 488 (5.7)                         | 0.004      |
| Thrombophlebitis or thrombosis             | 4 (1.5)                       | 35 (0.4)                          | 0.030      |
| Pneumonia                                  | 4 (1.5)                       | 25 (0.3)                          | 0.011      |
| Myocardial infarction                      | 3 (1.1)                       | 2 (0.02)                          | 0.001      |

\*Further results of encounters of patients with chest pain omitted from the table because of lacking significance: other diseases of the vertebral column and back, other diseases of the upper respiratory system, other injuries nose, hypertension, acute bronchitis and bronchiolitis, disease of the soft tissue, acute pharyngitis and tonsillitis, other psychological disorder, affective disorder, other diseases of the urinary system, pelvic- and stomach ache, other diseases of the ear, acute laryngitis and tracheitis, bronchial asthma, chronic polyarthritis and polyarthropathy, specific early complication of trauma, surgical intervention or medical treatment, herpes zoster, mycosis, hyperthyreosis, obesity, psychological disorder through alcohol, schizophrenia and delusional disorder, other diseases of the nervous system, other hypertension disease, other cardiologic diseases, other cerebrovascular diseases, atherosclerosis, influenza, chronic sinusitis, other diseases of the nose and the paranasal sinus, chronic inflammatory bowel disease, cholelithiasis and cholecystitis, acquired deformities of the limbs, changes in the bone density, fracture of the skull and facial bones, dislocation, and strain of special body regions. SESAM: Sächsische Epidemiologische Studie in der Allgemeinmedizin

## Discussion

In a daily general practice setting, we found the consultation rate of chest pain ranging from 0.7% to 3.0%. In the German SESAM 2 study and the Dutch Transition Project, dyspnea, anxiety, fear of diseases, and injuries were associated with chest pain. The broad majority of patients encountering chest pain received a physical examination. The physician's advice, drug prescription, and follow-up consultation were the most frequent therapeutic interventions. Chest pain was most commonly attributed to cardiovascular diseases, problems of the musculoskeletal, or respiratory system. Acutely dangerous courses were rare.

The consultation rate of chest pain as a reason for the encounter was remarkably higher in patients older than 45 years. This can be explained by a rising prevalence of chronic problems (e.g., musculoskeletal or cardiovascular ones) and by the increased rate of healthcare seeking in patients aged 60 years and over and by the ascending frequency of cardiovascular check-ups in these patients.<sup>[16,17]</sup> Other studies reported chest pain frequencies of about 1.5% (Sweden), 0.7% (Iceland), and 15.5/1000 patient-years (Great Britain) but similar findings especially the nearly doubling of the chest pain frequency from younger adults to the elderly, as seen in the Dutch Transition Project but also a first peak in the age group of 21–40 years.<sup>[6,7,18]</sup> The variation in the reported consultation frequencies [Table 4] may be explained by the different geographic backgrounds and different sampling methods of the mentioned studies. Furthermore, there is an influence on how individual patients of different cultural backgrounds respond to chest pain, for example to symptoms of the acute coronary syndrome.<sup>[19]</sup> These assumptions are supported by the fact that the Swiss Thoracic

Pain in Community (TOPIC) study, which was performed in a time period and with a population comparable to those in the German SESAM 2 study, revealed a nearly equal consultation frequency of chest pain [Table 4]. However, the higher rate in the German SESAM 2 study is unlikely to be influenced by attention bias since the study estimated total morbidity.

There are noticeable differences in diagnostic and therapeutic interventions between the German SESAM 2 Study and the Dutch Transition Project [Table 2]. Regarding the results of encounter in the German SESAM 2 study and other investigations, we can conclude that some of the diagnostic interventions may have been not necessary. Regarding other investigations of chest pain in general practice the design of the Swiss, TOPIC study was most similar to that of the German SESAM 2 study.<sup>[14,20]</sup> The percentages of the diagnostic and therapeutic interventions were comparable to that of the German SESAM 2 study. However, both investigations were at risk of being biased by socially desirable behavior. This is the case because the general practitioners documented the individual case by their own. This may have led to a broader use of diagnostic resources. This limitation could have been excluded by a total estimation of all consulting patients and electronic patient records. However, the electronic patient recording does not necessarily imply a high quality of documentation.<sup>[21]</sup> The results of our own investigation, as well as the findings reported by others, cannot provide information on the use of established diagnostic scores or applied diagnostic rapid-tests.

The results of encounter from patients that reported chest pain are presented in Table 4, the underlying categories, which could be partially critically discussed, were adopted from Verdon *et al.*<sup>[4]</sup> Despite

**Table 4: The frequency of chest pain (patients that consulted for chest pain related to all included patients of the respective study) and the results of encounter in different general practice studies. The data and comparison points were adopted from Verdon *et al.*<sup>[4]</sup> and supplemented with the results of the German SESAM 2 study and those of the DTP**

| Study                                 | ASPN       | Buntinx | Svavarsdottir | MIRNET           | SESAM 2           | TOPIC             | DTP                |
|---------------------------------------|------------|---------|---------------|------------------|-------------------|-------------------|--------------------|
| Time period                           | 1985       | 1988    | 1989          | 1992-1993        | 1999-2000         | 2001              | 1985-2003          |
| Region                                | USA/Canada | Belgium | Iceland       | USA              | Germany           | Switzerland       | Netherlands        |
| Total patients (n)                    | N/A        | N/A     | N/A           | N/A              | 8877              | N/A               | 149,238            |
| Total encounters (n)                  | 71,525     | N/A     | 28,050        | N/A              | 8877              | 24,620            | 597,312            |
| Patients chest pain (n)               | 832        | N/A     | N/A           | N/A              | 270               | 672               | 8117               |
| Encounters chest pain (n)             | 989        | 320     | 193           | 399              | 270               | 672               | 10,034             |
| Frequency chest pain (%) <sup>§</sup> | 1.4        | N/A     | 0.7           | N/A              | 3.0               | 2.7               | 1.7                |
| Musculoskeletal diseases (%)          | 28.7       | 29      | 48.9          | 36.2             | 33.0              | 48.7              | 14.3               |
| Cardiovascular diseases (%)           | 34.5       | 13.2    | 19.5          | 15.8             | 32.6              | 17.0              | 15.8               |
| Non ischemic heart disease            | N/A        | 8.4     | 15.8          | 3.8              | 15.6              | 3.5               | 1.6                |
| Ischemic heart disease <sup>^</sup>   | 31.6       | 4.8*    | N/A           | 10.5             | 14.4              | 12.6              | 10.0               |
| Myocardial infarction                 | 2.9        | N/A*    | 2.1           | 1.5 <sup>#</sup> | 1.1               | 0.6               | N/A                |
| Pulmonary embolism                    | N/A        | N/A*    | 1.6           | N/A              | 1.5 <sup>##</sup> | 0.3               | 0.2                |
| Psychogenic diseases (%)              | 7.5        | 17.1    | 4.7           | 7.5              | 6.4               | 11.3              | 8.9                |
| Respiratory diseases (%)              | 4.3        | 19.6    | 5.8           | 5.1              | 7.8               | 10.3              | 10.1               |
| Gastrointestinal diseases (%)         | 13.7       | 9.9     | 3.7           | 18.9             | 1.9               | 8.2               | 4.1                |
| Other diseases (%)                    | 11.3       | 10      | 7.9           | 16.1             | 15.9              | 2.2               | 5.7                |
| Without diagnosis (%)                 | N/A        | 1.3     | 9.5           | N/A              | N/A               | 3.1 <sup>**</sup> | 41.0 <sup>**</sup> |

<sup>§</sup>Calculated as encounters for chest pain per total encounters; <sup>^</sup>Stable and unstable angina pectoris; <sup>\*</sup>Life-threatening diseases summarized in the study; <sup>#</sup>Unstable angina pectoris and myocardial infarction; <sup>\*\*</sup>Without diagnosis was consisted of the following results for encounter: A97, K01, K02, K29, L04, R01; <sup>##</sup>Suspected deep vein thrombosis and chest pain. N/A: Not available; DTP: Dutch Transition Project; ASPN: Ambulatory Sentinel Practice Network; MIRNET: Michigan Research Network; SESAM: Sächsische Epidemiologische Studie in der Allgemeinmedizin; TOPIC: Thoracic Pain in Community

varying percentages of different organ systems being identified as the reason of chest pain, in five of the seven assessed studies, musculoskeletal problems were the most frequent underlying cause of chest pain in general practice. Found cardiovascular problems ranked second in four of seven studies and ranked first only in the North-American Ambulatory Sentinel Practice Network (ASPN) study and the Dutch Transition Project. Psychogenic and respiratory diseases occurred with approximately the same frequency. The most rare results of encounter belong to gastrointestinal diseases. In the Dutch Transition Project, 41% of the results of the encounter were coded as symptoms. This is generally in accordance with the results of others that showed that only 10% of the results of encounter in general practice can be assigned to a reliable diagnosis, but up to 50% are classified as “symptoms” and 40% as “named syndromes.”<sup>22,23</sup> Despite these limitations, it has to be pointed out that acutely dangerous courses such as suspected pulmonary embolism and suspected myocardial infarction occurred in 1–4% of all patients that encountered for chest pain. However, only in the North-American ASPN and the German SESAM 2 study suspected myocardial infarction was documented regularly frequently (more than one case in a total of 3000 consultations). Suspected pulmonary embolism was documented regularly frequently only in the German SESAM 2 study.

### Strengths of the recent investigation

As described elsewhere, the German SESAM 2 study supplies independent and representative cross-sectional data from a daily general practice setting.<sup>24</sup> A total of 209 general practitioners cooperated during the complete period of the study this is a much higher number than in the studies mentioned by Verdon *et al.*<sup>14</sup> In the Dutch Transition Project, a large number of patients consulting their general practitioner for chest pain was assessed. Since both studies estimated total morbidity, there is no attention or selection bias toward chest pain.

### Weakness of the recent investigation

The German SESAM 2 study is regionally specific; only general practitioners of Saxony were contacted and participated. The documentation was made by the general practitioners themselves and not by independent raters. House calls and “out-of-hour” contacts were not estimated in the study. An estimation of all patients was not possible, and the data do not represent the episodes of care. A valid statement on the quality of diagnoses of the German SESAM 2 study cannot be made since there was no follow-up documentation. Of the total number of general practitioners contacted, 10.9% participated in the German SESAM 2 study. This participation rate is low. However, the other studies [Table 4] were conducted with a much smaller number of general practitioners. This makes them more sensitive to effects of bias through specifics of individual patient populations and general practitioners. For this reason, there is no significant limitation resulting from a participation rate of 209 general practitioners in the German SESAM 2 study. The Dutch Transition Project has a large patient sample but was acquired from a small number of general practitioners. The

studies mentioned in Table 4 are not completely comparable. This is due to methodological differences and different regions and time periods of data assessment. One could argue that data was assessed a too long time ago. However, during the time of data assessment until publication there have been no fundamental changes beside an increasing mean age in the study population or in the German general practices, so it can be assumed that the spectrum of reasons for encounter and the approaches toward it changed only slightly. Since there was no other, more recently, assessed data published our results meanwhile do broaden the current knowledge on the topic.

## Conclusion

Chest pain is a common reason for an encounter in general practice. It is associated with dyspnea, anxiety, fear of diseases, and injuries. Chest pain occurs mainly due to musculoskeletal, circulatory, psychogenic, or digestive problems. In a daily general practice setting the underlying acutely dangerous causes are rare.

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### Conflicts of interest

There are no conflicts of interest.

## References

1. Ponka D, Kirlew M. Top 10 differential diagnoses in family medicine: Chest pain. *Can Fam Physician* 2007;53:2146.
2. Rosser W, Henderson R, Wood M, Green LA. An exploratory report of chest pain in primary care. A report from ASPN. *J Am Board Fam Pract* 1990;3:143-50.
3. Klinkman MS, Stevens D, Gorenflo DW. Episodes of care for chest pain: A preliminary report from MIRNET. Michigan Research Network. *J Fam Pract* 1994;38:345-52.
4. Verdon F, Herzig L, Burnand B, Bischoff T, Pécoud A, Junod M, *et al.* Chest pain in daily practice: Occurrence, causes, and management. *Swiss Med Wkly* 2008;138:340-7.
5. Richards SD. Atypical chest pain. Differentiation from coronary artery disease. *Postgrad Med* 1992;91:257-8, 263-8.
6. Svavarsdóttir AE, Jónasson MR, Gudmundsson GH, Fjeldsted K. Chest pain in family practice. Diagnosis and long-term outcome in a community setting. *Can Fam Physician* 1996;42:1122-8.
7. Ruigómez A, Rodríguez LA, Wallander MA, Johansson S, Jones R. Chest pain in general practice: Incidence, comorbidity, and mortality. *Fam Pract* 2006;23:167-74.
8. Sodi R, Hine T, Shenkin A. General practitioner (GP) cardiac

- troponin test requesting: Findings from a clinical laboratory audit. *Ann Clin Biochem* 2007;44(Pt 3):290-3.
9. Bösner S, Haasenritter J, Becker A, Karatolios K, Vaucher P, Gencer B, *et al.* Ruling out coronary artery disease in primary care: Development and validation of a simple prediction rule. *CMAJ* 2010;182:1295-300.
  10. Buntinx F, Knockaert D, Bruyninckx R, de Blaeij N, Aerts M, Knottnerus JA, *et al.* Chest pain in general practice or in the hospital emergency department: Is it the same? *Fam Pract* 2001;18:586-9.
  11. Okkes IM, Oskam SK, Van Boven K, Lamberts H. EFP. Episodes of care in Dutch Family Practice. Epidemiological data based on the routine use of the International Classification of Primary Care (ICPC) in the Transition Project of the Academic Medical Center/University of Amsterdam (1985-2003). In: Okkes IM, Oskam SK, Lamberts H, editors. *ICPC in the Amsterdam Transition Project*. CD-Rom. Amsterdam: Academic Medical Center, University of Amsterdam, Department of Family Medicine; 2005.
  12. Wockenfuß R. Assessing the reliability of ICD 10 in general practice. Doctoral thesis. Faculty of Medicine, University of Leipzig, Leipzig, Germany; 2010.
  13. Wockenfuß R, Frese T, Herrmann K, Claussnitzer M, Sandholzer H. Three- and four-digit ICD-10 is not a reliable classification system in primary care. *Scand J Prim Health Care* 2009;27:131-6.
  14. Soler JK, Okkes I, Wood M, Lamberts H. The coming of age of ICPC: Celebrating the 21<sup>st</sup> birthday of the International Classification of Primary Care. *Fam Pract* 2008;25:312-7.
  15. Lamberts H, Okkes I. Patients with chronic alcohol abuse in Dutch family practices. *Alcohol Alcohol* 1999;34:337-45.
  16. Adamson J, Donovan J, Ben-Shlomo Y, Chaturvedi N, Bowling A. Age and sex interaction in reported help seeking in response to chest pain. *Br J Gen Pract* 2008;58:318-23.
  17. Bösner S, Becker A, Haasenritter J, Abu Hani M, Keller H, Sönnichsen AC, *et al.* Chest pain in primary care: Epidemiology and pre-work-up probabilities. *Eur J Gen Pract* 2009;15:141-6.
  18. Nilsson S, Scheike M, Engblom D, Karlsson LG, Mölstedt S, Akerlind I, *et al.* Chest pain and ischaemic heart disease in primary care. *Br J Gen Pract* 2003;53:378-82.
  19. Deshmukh M, Joseph MA, Verdecias N, Malka ES, LaRosa JH. Acute coronary syndrome: Factors affecting time to arrival in a diverse urban setting. *J Community Health* 2011;36:895-902.
  20. Frese T, Herrmann K, Sandholzer H. Pruritus as reason for an encounter in general practice. *J Clin Med Res* 2011;3:223-9.
  21. Majeed A, Car J, Sheikh A. Accuracy and completeness of electronic patient records in primary care. *Fam Pract* 2008;25:213-4.
  22. Fink W, Lipatov V, Konitzer M. Diagnoses by general practitioners: Accuracy and reliability. *Int J Forecast* 2009;25:784-93.
  23. Soler JK, Okkes I. Reasons for encounter and symptom diagnoses: A superior description of patients' problems in contrast to medically unexplained symptoms (MUS). *Fam Pract* 2012;29:272-82.
  24. Goodacre S, Locker T, Morris F, Campbell S. How useful are clinical features in the diagnosis of acute, undifferentiated chest pain? *Acad Emerg Med* 2002;9:203-8.