The frequency and outcome of acute dyspnoea in primary care: An observational study

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ABSTRACT

Background: Little is known about the occurrence of acute dyspnoea in primary care and its underlying causes.

Objectives: What are the occurrence and most frequent causes of acute dyspnoea in primary care, predictors of referral, hospitalization, death and possible underlying causes?

Methods: Twenty-five general practitioners (GPs) in Flanders (Belgium) recorded patient contacts for four periods of two weeks during one year. They recorded patients presenting with acute dyspnoea, location of contact (surgery versus home visit), new dyspnoea versus exacerbation, tentative diagnosis, referral to a specialist and hospital, and one month later final diagnosis, its justification, referral, hospitalization and death.

Results: Twenty-two GPs recorded 14,620 patient contacts. Acute dyspnoea was encountered in 317 patient–doctor contacts (2.2%; 95%CI: 1.9–2.4), without significant association between the acute dyspnoea frequency, and age and gender. Immediate referral and hospitalization were most frequent in patients 61 to 90 years old. Forty-five patients (14.2%; 95%CI: 10.4–18.0) were referred to a specialist immediately and an additional 34 (10.7%; 95%CI: 7.3–14.1) by one month follow-up. Fourteen patients (4.4%) were hospitalized immediately, and 11 (3.5%) within one month. Six patients (1.9%), all 61 to 90 years old, died within one month.

Conclusion: Dyspnoea occurs in about two per cent of consultations. Serious cases are rare and are much more likely in the older age group. Twenty-five per cent of the contacts concerning acute or worsening dyspnoea were referred to a specialist or hospitalized. In daily practice, the risk of immediate referral, hospitalization and death is higher in men and older patients, especially if the contact is at the patient’s home.

Introduction

Acute shortness of breath or dyspnoea is a frequent reason for consulting in primary care.[1] The consultation prevalence of new occurrences of acute dyspnoea in the 2011 SESAM 2 study in general practices in Saxon (Germany) was 1.1% (data from 1 October 1999 to 30 September 2000), and in the Dutch Transition Project 2.5%.[2–4] Acute dyspnoea is defined as the sensation of difficult or uncomfortable breathing; it includes the perception of laboured breathing and the patient’s reaction to this sensation, and has many potential causes, predominantly related to cardiorespiratory disorders, but diagnosis can sometimes be very challenging.[5–8] Dyspnoea is not only a physical sensation (upper airway infections) but is also influenced by the psychological condition of the patient (anxiety, stress, etc.).[9] Most studies about acute dyspnoea, however, have been performed in
hospital settings, so little is known about its epidemiology, management and underlying causes in primary care.\[10\] A 2011 observational study of 8877 patients (adults presenting with acute dyspnoea in primary care in Saxon, Germany) found that emergency cases were rare in the general practitioner’s consultation and that the majority of underlying causes were acute respiratory infections and exacerbations of previously known chronic diseases.\[2\] A recent study by Viniol et al. \[11\] reported that except for pneumonia, further specification of underlying aetiologies seems difficult due to the between-study heterogeneity; they confirmed that there is still a lack of evidence on the prevalence and causes of dyspnoea.

Since information about acute or worsening dyspnoea in primary care is scarce, we conducted an observational study in primary care to determine the epidemiology, underlying causes, investigations, referrals, outcomes (including hospitalization and death) in adults and children presenting with acute dyspnoea in primary care. We also explored the predictive effect of age and gender on referral, hospitalization, death and final diagnoses.

Methods

Study design

A sample of 37 general practitioners (GPs) in Flanders, Belgium, was invited by email and no personal information was asked or recorded. There was one telephone reminder afterwards without additional questions asked. The GPs who agreed recorded age and gender of all adults and children presenting during four periods of two weeks (one period in each season) between 1 March 2012 and 28 February 2013. The GPs completed a clinical pro forma for any patient complaining of either acute dyspnoea or an exacerbation of known dyspnoea or who was diagnosed with acute dyspnoea by the GP. A patient was only included once during the whole study period. The following information was collected: gender, age (years), contact location (surgery or home visit), whether first occurrence or worsening of a known dyspnoea, as well as tentative diagnosis, referral for specialist consultant and immediate hospitalization. No additional signs and symptoms were recorded.

After one month, the GPs completed a second form for each included patient based on all details available to them from their records. The requested information included a final diagnosis based on signs and symptoms, laboratory results, ECG, echocardiography, spirometry, X-ray and other imaging studies, other investigations if available, as well as referral to a specialist, hospitalization and death.

When a patient was seen more than once for the same episode of acute dyspnoea, only the first contact was recorded. We excluded patients who consulted during out of hours (on call) sessions unless they were the GP’s own patients.

Ethics

The Ethical Review Board of the medical faculty of Leuven University approved the study (no: ML7968). Patients were informed about the study by information leaflets in the waiting room of each participating surgery, and had the option of not participating, but signed consent was not required. All patient identifiers were removed from the clinical pro formas following data collection.

Classification

Both the initial and the final diagnoses were categorized according to the International Classification of Primary Care (ICPC-2) and classified as heart failure (K77), acute infection of the upper airways (R74), acute bronchitis/bronchiolitis (R78), pneumonia (R81), chronic obstructive pulmonary disease (COPD, R95), asthma (R96), hyperventilation (R98) and ‘other’ diagnoses.

Statistical analysis

Descriptive information was presented by frequencies or means, and 95% confidence intervals (95%CI) were calculated using confidence interval analysis. Differences between groups were considered significant if the 95%CIs did not overlap.

We examined the independent effect of age (10-year categories), gender, location of appointment (surgery versus home visit) and an acute versus a worsening exacerbation of known dyspnoea on need for referral, hospitalization or death during the initial doctor–patient contact using backward stepwise multiple logistic regression analysis. The fit of the calculated model was examined via Hosmer and Lemeshow analysis, a $P > 0.05$ was considered acceptable. Results were presented as odds ratios (ORs) with 95%CIs.

Results

Patient characteristics

Twenty-five of the 37 contacted GPs (67.6%) agreed to participate in the study, of whom 22 recorded data for
all four periods, providing data on 14,620 patient–doctor contacts during a total recording period of 194 weeks. Overall 317 (2.2%; 95%CI: 1.9–2.4) patients presented with acute or worsening dyspnoea during this period. The frequency of consultations for acute or worsening dyspnoea in winter was 2.8% while it was 1.8–2.3% in other seasons. The 61 to 90 years old group contacted more frequently (2.8%) than the other age groups (1.8–2.3%).

A new episode of acute dyspnoea occurred in 194 patients (61.2%) and 123 had an acute exacerbation of known dyspnoea (38.8%) (Table 1). Of the 317 patients, 263 were seen at the surgery (83%) and 54 needed a home visit (17%).

**Frequency of acute dyspnoea**

We found no significant association between the prevalence of patients presenting with acute or worsening dyspnoea and either gender or age. Most included patients were seen at the surgery, except for the five patients older than 90 years of age, seen exclusively at home. Men tended to be seen at home less frequently than women are (OR: 0.56, 95%CI: 0.30–1.05). There were no significant differences in the frequency of episodes of acute dyspnoea versus exacerbations of known dyspnoea ($P = 0.201$), although there seemed to be a trend towards an increased occurrence of exacerbations with increasing age (61 to 90 years old and >90 years old).

Based on multiple logistic regression analysis, male gender was the only significant independent predictor of immediate hospitalization and death (Table 2). A home visit was a significant predictor of immediate hospitalization compared to being seen at the surgery, as was the occurrence of an exacerbation of known dyspnoea compared to an episode of new, acute dyspnoea.

**Outcomes of patients with acute or worsening dyspnoea**

Immediate referral to a specialist consultant or hospitalization of patients with dyspnoea occurred most frequently in patients between 61 and 90 years old, but no immediate referral occurred in patients above age 90.

Forty-five (14.2%; 95%CI: 10.4–18.0) patients with acute or worsening dyspnoea were referred to a specialist consultant immediately (Appendix 1) and a further 34 (10.7%; 95%CI: 7.3–14.1) within one month of initial contact and related to the initial dyspnoea problem. Referrals occurred most frequently to pulmonology (11.0%), cardiology (8.8%), paediatrics (1.6%) or geriatrics (1.3%) (Appendix 2).

Fourteen (4.4%; 95%CI: 2.4–7.3) patients with dyspnoea were hospitalized immediately and a further 11 (3.5%; 95%CI: 1.7–6.1) within one month of the initial contact, also related to the initial dyspnoea complaint. Of those 25 patients, 15 (4.7%) were hospitalized in pulmonology wards, five (1.6%) in cardiology wards, three (0.9%) in geriatric wards and five (1.6%) in other wards (one child in paediatrics, the others in cardiothoracic surgery, gastroenterology and nephrology), some of them for several specialties (Appendix 2). In the total referred group patients, disorders that most frequently led to hospitalization at any point up to 30 days were acute exacerbations of COPD (AECOPD) ($n = 7$), heart failure ($n = 5$) and pneumonia ($n = 5$).

| Year group          | Dyspnoea patients | Dyspnoea patients |
|---------------------|-------------------|-------------------|
|                     | Male (%)          | Female (%)        |
| All patients        | 6304 (43.1)       | 8361 (56.9)       |
| 0–30 years          | 50 (2.3)          | 2475 (53.5)       |
| 0–18 years          | 41 (1.9)          | 22 (0.9)          |
| 19–30 years         | 9 (0.4)           | 22 (0.9)          |
| 31–60 years         | 3186 (57.6)       | 66 (2.1)          |
| 61–90 years         | 2493 (58.6)       | 68 (2.7)          |
| >90 years           | 162 (76.1)        | 4 (2.5)           |

*We did record the denominator (total number of patients seen) according to 30-years age-groups. However, we do not have the stratification in two groups within the 30–30 year age-groups.*

| Predictor                  | Immediate referral* ($n = 45$) | Immediate hospitalization* ($n = 14$) | Death* ($n = 6$) |
|----------------------------|-------------------------------|--------------------------------------|-----------------|
| Age (per 10 years)         | 1.23 (1.07–1.41)              | 3.82 (1.08–13.45)                    | 12.89 (1.29–128.76) |
| Gender: male versus female |                               | 16.67 (16.67–100)                    |                 |
| Visit at home versus surgery|                               | 4.17 (1.04–16.67)                    |                 |
| Hosmer and Lemeshow (P)    | 0.89                          | 0.59                                 | 1                |

*During the initial contact.  
Within one month after initial contact.
Six (1.9%; 95%CI: 0.7–4.1) patients with acute dyspnoea died within one month of initial contact, all of whom were in the 61 to 90 age group. Causes of death were: respiratory insufficiency caused by primary lung cancer (n = 2); lung metastasis (n = 1); heart failure (n = 2); and acute exacerbation of COPD (n = 1).

**Predictors of diagnostic outcome categories in patients with acute dyspnoea**

Gender was not a significant predictor of any of the diagnostic categories (Appendix 3). Patients with acute or worsening dyspnoea less than 30 years of age were significantly more likely to have a diagnosis of asthma (33/94; 35.1%), or acute bronchitis/bronchiolitis (32/94; 34.0%) than other diagnoses, more than 75% were children under 18 years of age. In the age group >90 years, four out of the five were more likely to have heart failure. None of the other age categories was significantly associated with diagnoses. Visit at the surgery was a significant predictor for acute bronchitis/bronchiolitis (64/263; 24.2%) or asthma (50/293; 18.9%). Home visits were preferably significant predictors for acute heart failure (13/54; 24.5), pneumonia (13/54; 24.5) and AECOPD (11/54; 20.8). The occurrence of an episode of acute dyspnoea was predictive for acute bronchitis/bronchiolitis (54/194; 28.0%) and of a new episode of known dyspnoea for AECOPD (30/123; 24.2%) or asthma (32/123; 25.8%).

**Investigations performed in patients with acute dyspnoea**

Most patients, 291 out of 317 (91.8%; 95%CI: 88.2–94.6), did not have further investigations, with final diagnoses assigned based on only signs and symptoms. In 55 patients (17.4%) laboratory results were used for diagnosis, in 23 (7.3%) an ECG was performed and in 54 (17.0%) an X-ray, immediately related to the consultation for acute dyspnoea. Echocardiography was performed in 11 patients (3.5%), spirometry in 13 (4.1%) and CT, MRI, SPECT or other imaging techniques in seven (2.2%).

**Discussion**

**Main findings**

Consultations for acute dyspnoea make up 2.2% of GP consultations by adults and children. The vast majority (92%) are managed in primary care without additional testing or referral. The most common causes in children are acute bronchiolitis and asthma, and in adults acute bronchitis, asthma, pneumonia, AECOPD and acute upper airway infections. Serious underlying disorders are rare and occurred in 20 patients (6.3%). Women are more likely to consult for acute dyspnoea than men are, even when corrected for the higher consultation rates by women in general. This is similar to other studies.[12] The reason for this is unknown. Most of the contacts occurred at the surgery (83%), similar to the 91.1% in Viniol’s study,[11] except for patients above age 90. This seems logical since these patients are usually less mobile or present conditions making them unable to go to the surgery. Nevertheless, nearly one-quarter (24.9%) of patients were referred to a specialist consultant (mostly for acute bronchitis and asthma) and 7.9% of patients are hospitalized, and almost all of the latter occur in the 60 to 90 age group. This reflects the fact that exacerbations of pre-existing conditions as well as serious underlying pathology are more frequent in this age group. Another study gives lower numbers of referral and hospitalization, respectively 15.7% and 4.9%.[13] The reason could be different approach by patients as well as GPs in Australia than in Belgium and the exclusion of the people younger than 18 years. Although numbers were small, there was a strong association between male gender and mortality, probably because conditions associated with smoking (COPD, lung cancer, higher cardiovascular risk) are more frequent in men, although frequency in women is increasing.[14]

**Strength and weaknesses**

The strength of this study is that it was performed in daily practice, which leads to representative results about the occurrence of dyspnoea in primary care. By recruiting throughout the year, we avoided seasonal discrepancies as much as possible. Our prevalence corresponds with the findings of other studies, ranging from 0.85 to 2.59%.[10,11] Another strength of the study is that it produces some evidence about predictors and also about most frequent diagnoses in people complaining of acute dyspnoea, while other studies could not produce such details.[11] However, the study had several limitations. First, the statistical power of this study was limited as the number of patients with dyspnoea was limited. Second, we did not include a random sample of Flemish GPs, but we approached GPs known personally to the authors (many of whom are involved in GP training or academic work), which may have introduced bias into both the study population and the quality of the recorded data. As this is a sample from known GPs, they are not representative of all GPs in
Belgium. However, we are not aware of differences in patient populations between academic GPs and other GPs so we feel this is likely to have been a representative sample. We compared the age and sex distribution of our sample to the Intego population, which is a large-scale ongoing morbidity registration in Flemish general practices and found no real differences.[15] Third, not all GPs performed their recordings completely, three of them only recorded during three periods. This may also result in biased data since during these periods dyspnoea may have been more or less frequent. Finally, diagnostic tests were only conducted based on clinical indication, so it is not possible to verify aetiology in those whom tests were not performed, but this is similar to most observational studies in primary care.

This study points out that asthma and acute bronchitis/bronchiolitis are the most important causes of consulting in patients with acute dyspnoea. We provided information over the incidence of diseases in patients with new or worsening dyspnoea and over the whole range of possible diseases and stratifying for groups of age, sex and type of dyspnoea.

Clinical implications
A patient with dyspnoea consulting at the surgery is more likely to have asthma or bronchitis/bronchiolitis. GPs must be aware that being a man and having worsening of known dyspnoea are more likely to lead to hospitalization. The risk for severe diseases as reason for acute dyspnoea is higher in home visits.

For (especially junior) GPs it is important to have an idea about the list of most frequent diagnoses in patients with specific signs and symptoms as well as the relative frequency of different diseases in those patients. This is even more so when teaching students. Prior chances differ according to age, type of contact (surgery or contact at the patient’s home), and the difference between first episodes and an exacerbation of known dyspnoea. Teachers can find the necessary information in Appendices 2 and 3.

Research implications
Even after this study, the evidence on occurrence and risk factors of dyspnoea in primary care remains scarce and additional similar studies would be welcome. Also, more evidence on the predictive value of dyspnoea, with and without other signs and symptoms, is urgently needed. This may result from data analysis of existing databases, including both signs and symptoms and diagnostic categories. As such, databases are rare, specifically designed studies will be required.

Conclusion
Dyspnoea occurs in approximately two per cent of consultations. Serious cases are rare and are much more likely in the older age group. Twenty-five per cent of the contacts concerning acute or worsening dyspnoea were referred to a specialist or hospitalized. In daily practice, the risk of immediate referral, hospitalization and death is higher in men and in older patients, especially if the contact is at the patient’s home.

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Declaration of interest
The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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References
[1] Breitenbücher A. From understanding the pathophysiological mechanisms of dyspnoea to the correct symptomatic treatment. Ther Umsch. 2006;63:211–216.
[2] Frese T, Sobeck C, Herrmann K, et al. Dyspnoea as the reason for encounter in general practice. J Clin Med Res. 2011;3:239–246.
[3] FaMe-net. Improving the quality of family medicine [Internet]. [cited 2016 May]. Available from: http://www.transhis.nl
[4] Lamberts H, Oskam SK, Okkes IM. The clinical relationship between symptoms and the final diagnosis in general practice, determined by means of posterior probabilities calculated on the basis of the transition Project. Ned Tijdschr Geneeskd. 2005;149:2566–2572.
[5] Rao A, Gray D. Breathlessness in hospitalised adult patients. Postgrad Med J. 2003;79:681–685.
[6] Yernault J. Dyspnoea in the elderly: A clinical approach to diagnosis. Drugs Aging. 2001;18:177–187.
Appendix 1

Distribution of patients with dyspnoea for age and sex classes and according to contact, referral, hospitalization and death characteristics.

| Dyspnoea | Visit at surgery n (%) | Visit at home n (%) | New dyspnoea n (%) | Known dyspnoea n (%) | Referral a n (%) | Hospitalization a n (%) | Death a n (%) |
|----------|------------------------|---------------------|---------------------|----------------------|-----------------|-------------------------|--------------|
| Male     | 135                    | 118 (87.4)          | 17 (12.6)           | 77 (57)              | 58 (43)         | 24 (17.8)               | 9 (6.7)      |
| Female   | 182                    | 145 (79.7)          | 37 (20.3)           | 117 (64.3)           | 65 (35.7)       | 21 (11.5)               | 5 (2.7)      |
| 0–30 years | 94                     | 92 (97.9)           | 2 (2.1)             | 59 (62.8)            | 35 (37.2)       | 8 (8.5)                 | 1 (1.1)      |
| 0–18 years | 63                    | 62 (98.4)           | 1 (1.6)             | 39 (61.9)            | 24 (38.1)       | 6 (9.5)                 | 1 (1.6)      |
| 19–30 years | 31                   | 30 (96.8)           | 1 (3.2)             | 20 (64.5)            | 11 (35.5)       | 2 (6.5)                 | 0 (0)        |
| 31–60 years | 98                   | 96 (98)             | 2 (2)               | 70 (71.4)            | 28 (28.6)       | 9 (9.2)                 | 2 (2)        |
| 61–90 years | 120                 | 70 (62.5)           | 45 (37.5)           | 63 (52.5)            | 57 (47.5)       | 28 (23.3)               | 11 (9.2)     |
| >90 years | 5                      | 0 (0)               | 5 (100)             | 2 (4)                | 1 (2)           | 0 (0)                   | 0 (0)        |
| Male 0–30 years | 50               | 49 (98)             | 1 (2)               | 32 (64)              | 18 (36)         | 6 (12)                  | 1 (2)        |
| 0–18 years | 41                    | 40 (97.6)           | 1 (2.4)             | 26 (63.4)            | 15 (36.6)       | 4 (9.8)                 | 1 (2.4)      |
| 19–30 years | 9                     | 9 (100)             | 0 (0)               | 6 (66.7)             | 3 (33.3)        | 2 (22.2)                | 0 (0)        |
| Male 31–60 years | 32               | 32 (100)            | 0 (0)               | 20 (62.5)            | 12 (37.5)       | 4 (12.5)                | 1 (3.1)      |
| Male 61–90 years | 52               | 37 (71.2)           | 15 (28.8)           | 25 (48.1)            | 27 (51.9)       | 14 (26.9)               | 7 (13.5)     |
| Male >90 years | 1                   | 0 (0)               | 1 (100)             | 0 (0)                | 1 (100)        | 0 (0)                   | 0 (0)        |
| Female 0–30 years | 44               | 43 (97.7)           | 1 (2.3)             | 27 (61.4)            | 17 (38.6)       | 2 (4.5)                 | 0 (0)        |
| 0–18 years | 22                    | 22 (100)            | 0 (0)               | 13 (59.1)            | 9 (40.9)        | 2 (9.1)                 | 0 (0)        |
| 19–30 years | 22                    | 21 (95.5)           | 1 (4.5)             | 14 (63.6)            | 8 (36.4)        | 0 (0)                   | 0 (0)        |
| Female 31–60 years | 66              | 64 (97)             | 2 (3)               | 50 (75.8)            | 16 (24.2)       | 5 (7.6)                 | 1 (1.5)      |
| Female 61–90 years | 68              | 38 (55.9)           | 30 (44.1)           | 38 (55.9)            | 30 (44.1)       | 14 (20.6)               | 4 (5.9)      |
| Female >90 years | 4                   | 0 (0)               | 4 (100)             | 2 (50)               | 2 (50)          | 0 (0)                   | 0 (0)        |

aDuring the initial contact.

bWithin one month after initial contact.

Appendix 2

Referrals and hospitalization of the patients presenting with acute or worsening dyspnoea in general practice.

| Referrals of 79 (45 and additional 34) patients | Hospitalization | n | % on 317 | 95%CI | n | % on 317 | 95%CI |
|-----------------------------------------------|-----------------|----|----------|-------|----|----------|-------|
| To pulmonology                                 | 35              | 11 | 11        | 7.6–14.5 | Pulmonology ward | 15 | 4.7 | 2.7–7.7 |
| To cardiology                                  | 28              | 8.8| 8.8       | 6.0–12.5 | Cardiology ward  | 5  | 1.6 | 0.5–3.6 |
| To paediatrics                                 | 5               | 1.6| 1.6       | 0.5–3.6  | Geriatric ward   | 3  | 0.9 | 0.2–2.7 |
| To geriatrics                                  | 4               | 1.3| 1.3       | 0.3–3.2  | Other wards a    | 5  | 1.6 | 0.5–3.6 |
| To neuropsychiatry                             | 3               | 0.9| 0.9       | 0.2–2.7  |                 |     |     |        |
| To gastroenterology                            | 2               | 0.6| 0.6       | 0.08–2.3 |                 |     |     |        |
| To cardiothoracic surgery                      | 2               | 0.6| 0.6       | 0.08–2.3 |                 |     |     |        |
| To otorhinolaryngology                         | 2               | 0.6| 0.6       | 0.08–2.3 |                 |     |     |        |
| To other specialists a                         | 12              | 3.8| 3.8       | 2.0–6.5  |                 |     |     |        |

aOther specialists: accident and emergency, endocrinology, oncology, nephrology, obstetrics and gynaecology.

bOther wards: paediatrics, cardiothoracic surgery, gastroenterology and nephrology.

95%CI, 95% confidence interval;
Appendix 3

Predictors of dyspnoea. Distribution of diagnostic categories (by the International Classification of Primary Care (ICPC-2) for age and sex classes, and according to contact and dyspnoea characteristics, with their 95% confidence interval.

| Gender       | Heart failure | Acute infection of the upper airways | Acute bronchitis/bronchiolitis | Pneumonia | COPD | Asthma | Hyperventilation | Other |
|--------------|---------------|--------------------------------------|--------------------------------|-----------|------|--------|-----------------|-------|
| Male (n = 135) | 9 6.7% (2.5–10.9) | 10 7.4% (3–11.8) | 37 27.4% (19.9–34.9) | 13 9.6% (4.7–14.6) | 18 13.3% (7.6–19.1) | 22 16.3% (10.1–22.5) | 8 5.9% (1.9–9.9) | 28 20.7% (13.9–27.6) |
| Female (n = 182) | 11 6% (2.6–9.5) | 16 8.8% (4.7–12.9) | 31 17% (11.6–22.5) | 25 13.7% (8.7–18.7) | 19 10.4% (6.4–14.9) | 33 18.1% (12.5–23.7) | 16 8.8% (4.7–12.9) | 52 28.6% (22–35.1) |

**Age**

| Age          | Heart failure | Acute infection of the upper airways | Acute bronchitis/bronchiolitis | Pneumonia | COPD | Asthma | Hyperventilation | Other |
|--------------|---------------|--------------------------------------|--------------------------------|-----------|------|--------|-----------------|-------|
| 0–30 years (n = 94) | 0 0% | 11 11.7% (5.2–18.2) | 32 34% (24.5–43.6) | 4 4.3% (0.2–8.3) | 0 0% | 33 35.1% (25.5–44.8) | 5 5.3% (0.8–9.9) | 15 16% (8.6–23.4) |
| 0–18 years (n = 63) | 0 0% | 6 9.5% (2.3–16.8) | 25 39.7% (27.6–51.8) | 3 4.8% (–0.5–10) | 0 0% | 25 39.7% (27.6–51.8) | 1 1.6% (–1.5–4.7) | 6 9.5% (2.3–16.8) |
| 19–30 years (n = 31) | 0 0% | 5 16.1% (3.2–29.1) | 7 22.6% (7.9–37.3) | 1 3.2% (–3–9.4) | 0 0% | 9 29% (13.1–45) | 4 12.9% (1.1–24.7) | 9 29% (13.1–45) |
| 31–60 years (n = 98) | 0 0% | 7 7.1% (2–12.2) | 22 22.4% (14.2–30.7) | 10 10.2% (4.2–16.2) | 9 9.2% (3.5–14.9) | 14 14.3% (7.4–21.2) | 14 14% (7.4–21.2) | 25 25.5% (16.9–34.1) |
| 61–90 years (n = 120) | 16 13.3% (7.3–19.4) | 8 6.7% (2.2–11.1) | 14 11.7% (5.9–17.4) | 22 18.3% (11.4–25.3) | 27 22.5% (15–30) | 7 5.8% (1.6–10) | 5 4.2% (0.6–7.7) | 40 33.3% (24.9–41.8) |
| >90 years (n = 5) | 4 80% (44.9–115.1) | 0 0% | 0 0% | 2 40% (–29–82.9) | 1 20% (–15.1–55.1) | 1 20% (–15.1–55.1) | 0 0% | 0 0% |

**Location of contact**

| Type of dyspnoea | Heart failure | Acute infection of the upper airways | Acute bronchitis/bronchiolitis | Pneumonia | COPD | Asthma | Hyperventilation | Other |
|-----------------|---------------|--------------------------------------|--------------------------------|-----------|------|--------|-----------------|-------|
| Surgery (n = 263) | 7 2.7% (0.7–4.6) | 23 8.7% (5.3–12.2) | 64 24.3% (19.1–29.5) | 25 9.5% (6.0–13.1) | 26 9.9% (6.3–13.5) | 50 19% (14.3–23.8) | 22 8.4% (5.0–11.7) | 67 25.5% (20.2–30.7) |
| Home (n = 54) | 13 24.1% (12.7–35.5) | 3 5.6% (–0.6–11.7) | 4 7.4% (0.4–14.4) | 13 24.1% (12.7–35.5) | 11 20.4% (9.6–31.1) | 5 9.3% (1.5–17) | 2 3.7% (–1.3–8.7) | 13 24.1% (12.7–35.5) |
| New dyspnoea (n = 194) | 5 2.6% (0.3–4.8) | 19 9.8% (5.6–14) | 54 27.8% (21.5–34.1) | 24 12.4% (7.7–17) | 7 3.6% (1–6.2) | 23 11.9% (7.3–16.4) | 16 8.2% (4.4–12.1) | 63 32.5% (25.9–39.1) |
| Known dyspnoea (n = 123) | 15 12.2% (6.4–18) | 7 5.7% (1.6–9.8) | 14 11.4% (5.8–17) | 14 11.4% (5.8–17) | 30 24.4% (16.8–32) | 32 26% (18.3–33.8) | 8 6.5% (2.1–10.9) | 17 13.8% (7.7–19.9) |

*aThe percentages refer to all patients with new or worsening dyspnoea and with the characteristic mentioned in the first column. 95%CI, 95% confidence interval.*