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Get with the guidelines: management of chronic obstructive pulmonary disease in emergency departments in Europe and Australasia is sub-optimal

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Abstract

Background: Exacerbations of chronic obstructive pulmonary disease (COPD) are common in emergency departments (ED). Guidelines recommend administration of inhaled bronchodilators, systemic corticosteroids and antibiotics along with non-invasive ventilation (NIV) for patients with respiratory acidosis.

Aim: To determine compliance with guideline recommendations for patients treated for COPD in ED in Europe (EUR) and South East Asia/Australasia (SEA) and to compare management and outcomes.

Methods: In each region, an observational prospective cohort study was performed that included patients presenting to ED with the main complaint of dyspnoea during three 72-h periods. This planned sub-study included those with an ED primary discharge diagnosis of COPD. Data were collected on demographics, clinical features, treatment, disposition and in-hospital mortality. We determined overall compliance with guideline recommendations and compared treatments and outcome between regions.

Results: A total of 801 patients was included from 122 ED (66 EUR and 46 SEA). Inhaled bronchodilators were administered to 80.3% of patients, systemic corticosteroids to 59.5%, antibiotics to 44 and 60.6% of patients with pH <7.3 received NIV. The proportion administered systemic corticosteroids was higher in SEA (EUR vs SEA for all

*See pp. 205–207 for full details of the AANZDEM and EuroDEM Study Groups.

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comparisons; 52 vs 66%, $P < 0.001$) as was administration of antibiotics (40 vs 49%, $P = 0.02$). Rates of NIV and mechanical ventilation were similar. Overall in-hospital mortality was 4.2% (SEA 3.9% vs EUR 4.5%, $P = 0.77$).

Conclusion: Compliance with guideline recommended treatments, in particular administration of corticosteroids and NIV, was sub-optimal in both regions. Improved compliance has the potential to improve patient outcome.

Introduction

Shortness of breath is one of the main reasons patients present to an emergency department (ED).[1] Previously published research from the Asia-Pacific region reports that this symptom accounts for 5% of all ED presentations. Chronic obstructive pulmonary disease (COPD) was found to be the main ED diagnosis in 14% of these presentations.[2]

Recent guidelines[3,4] recommend several treatments in the acute phase of care in order to optimise outcomes. These include the use of controlled oxygen therapy, inhaled bronchodilators, systemic corticosteroids, antibiotics if there is clinical, laboratory or chest X-ray (CXR) evidence of bacterial infection, the taking of a CXR, blood gas analysis for cases classified as more than mild severity and non-invasive ventilation (NIV) in patients with significant respiratory acidosis (pH < 7.35). To date, evidence regarding compliance with these elements in ED suggests gaps in compliance.[5–7] Most of these studies are single site or single region raising questions about generalisability.

The aim of this study was to determine overall compliance with guideline recommendations and to compare management and in-hospital outcomes between patients treated for ED-diagnosed COPD in Europe (EUR) and South East Asia/Australasia (SEA), in particular compliance with guideline recommendations.[8]

Methods

This is a combination of two international, multicentre, prospective, interrupted time series cohort studies, both occurring in 2014. They were designed to evaluate the epidemiology, treatment and in-hospital outcome of patients presenting to ED with shortness of breath as the main complaint. The EuroDEM study was conducted in 66 European centres (Belgium 3, Finland 5, France 5, Germany 5, Italy 1, The Netherlands 16, Romania 7, Spain 1, Turkey 7 and United Kingdom 16). The AANZDEM study was conducted in 46 Asia-Pacific/Australian centres (Australia 33, New Zealand 4, Singapore 3, Hong Kong 4 and Malaysia 2). The study sample was generated with consecutive patients attending EDs during three study periods of 72 h each throughout 1 year. Detailed methodology for AANZDEM has been published previously.[9] The patient population of interest was consecutive adult patients presenting to the ED with acute dyspnoea as a main symptom. The studies were performed in accordance with the Declaration of Helsinki. Ethics committee approvals were obtained for all sites according to local requirements. If requested by the local ethics committee, patient consent for data collection was obtained. The population of interest for this sub-study were patients with an ED discharge diagnosis of COPD (Fig. 1).

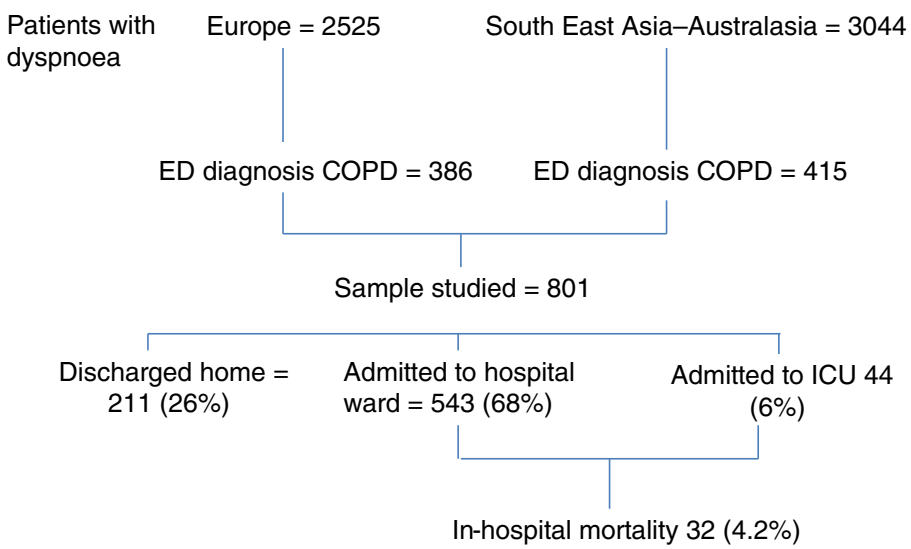

Figure 1 Sample derivation.

A specifically designed data collection form was developed independently by each steering committee. Data were collected by local site investigators and submitted to central databases in each region as de-identified data. Data collected included patient characteristics, comorbidities, mode of arrival, usual medications, prehospital treatment as documented in ED clinical records, initial assessment (clinical assessment and vital signs), investigations performed (laboratory tests, electrocardiogram, imaging, etc.) and results, treatment in the ED, final ED diagnosis, in-hospital outcome including disposition, in-hospital mortality and final hospital diagnosis. There were some minor differences in data points, for example, EUR did not collect data on imaging. Local data collectors were not blinded to objectives of the parent studies although they were unaware that specific comparative - sub-analyses by condition would be undertaken.

The outcomes of interest were compliance with guideline recommended treatment and comparison of treatment and outcome (disposition and in-hospital mortality) between EUR and SEA. Published COPD guidelines were used as the reference standard for treatment.[3,4] We assumed that patients attending an ED for care had at least a moderate exacerbation of COPD. Results are presented as frequencies or as medians with interquartile range (IQR). The Chi-squared test or Fisher's exact test (as appropriate) was used to compare categories. Continuous variables were compared using the Mann-Whitney test (nonparametric). Statistical significance was defined as $P < 0.05$. Statistical analysis was performed using SAS version 9.1 software (SAS Institute, Cary, NC, USA) and Analyse-It (Anylyse-it Software Ltd, Leeds, UK; https://analyse-it.com/).

Results

Eight hundred and one patients had a final ED diagnosis of COPD and formed the study population; 415 SEA and 386 EUR. In SEA, 44 sites contributed cases with a median number of cases/site of 8.5 (IQR 5–14, range 1–22). In EUR, 59 sites contributed cases with a median number of cases/site of 5 (IQR 2–9, range 1–25). Variability in the number of cases/site was expected due to differences in ED size and caseload.

Median age was 72 and 58% of patients were male. Median duration of symptoms was 3 days (IQR 1–7). The cohorts were mostly comparable for comorbidities with 90.4% having a past history of COPD, 18% a past history of heart failure and 24% a past history of coronary artery disease (Table 1). Of note, there was a significant difference in reported (current) smoking rates – SEA 23.8 versus 40.8% EUR ($P < 0.001$).

Table 1 Patient characteristics

	Total	AANZDEM	Missing data	EuroDEM	Missing data	*P*-value
n (%)	801	415 (51.8)		386 (48.2)		
Age, median (IQR) (years)	72 (64–80)	73 (65–81)	0	71 (63–78)	3	<0.001
Male, *n* (%)	466 (58.3)	249 (60.0)	0	217 (57)	2	0.3
Duration of symptoms, median (IQR) (days)	3 (1–7)	3 (1–7)	17	3 (2–6)	66	0.84
Co-morbidities, *n* (%)						
Prior history of COPD	720 (90.8)	375 (90.6)	1	345 (91)	7	0.92
Smoker	254 (32.8)	98 (23.8)	3	156 (43.1)	24	<0.001
Chronic heart failure	142 (18.4)	73 (17.7)	3	69 (19.2)	26	0.79
Diabetes mellitus	162 (20.9)	78 (19.0)	4	84 (23)	21	0.2
Hypertension	398 (51)	215 (52.2)	3	183 (49.6)	17	0.52
Coronary artery disease	182 (23.8)	102 (24.8)	3	80 (22.7)	33	0.55
Atrial fibrillation/flutter	99 (12.7)	55 (13.3)	3	44 (12)	18	0.63
Chronic renal disease	73 (9.3)	47 (11.4)	3	24 (6.4)	11	0.02
Active malignancy	40 (5.1)	22 (5.4)	4	18 (4.9)	16	0.88
Asthma	112 (14.2)	54 (13.1)	2	58 (15.4)	10	0.43
Prior pulmonary embolism	37 (4.7)	17 (4.1)	3	20 (5.4)	18	0.813
Chronic medication use, *n* (%)						
Inhaled beta-2 agonists	553 (69.1)	308 (74.4)	1	245 (63.5)	0	0.001
Inhaled corticosteroids	455 (56.9)	211 (51)	1	244 (63.2)	0	<0.001
Oral steroids	140 (17.5)	68 (16.5)	2	72 (18.7)	0	0.47
Home oxygen	117 (14.7)	57 (13.8)	3	60 (15.5)	0	0.56
Diuretics	210 (26.3)	89 (21.5)	2	121 (31.3)	0	0.002
Mode of arrival, *n* (%)						
By ambulance	490 (62.5)	260 (64.5)	12	230 (60.4)	5	0.24

COPD, chronic obstructive pulmonary disease; IQR, interquartile range.

Regarding regular medications, the EUR cohort had lower use of inhaled beta-agonists (63.5 vs 74.4%, $P < 0.001$) and higher use of diuretics (31.3 vs 21.5%, $P < 0.001$). Home oxygen usage rates were similar (Table 1). Clinical features at presentation were similar, including the proportion with clinically significant acidosis (overall 8.2%) (Table 2).

The proportion of patients who received the defined evidence-based treatments was sub-optimal – inhaled bronchodilators 80.3% and systemic corticosteroids 59.5%. The proportion of patients receiving systemic corticosteroids was lower in EUR than SEA (52.6 vs 65.9%, $P < 0.001$) as was administration of antibiotics (40.2 vs 48.5%, $P = 0.003$). NIV and mechanical ventilation rates were similar (Table 3).

While the proportion of patients requiring intensive care unit admission was similar (5.5%), the proportion of patients discharged home from ED was significantly higher in EUR compared to SEA (33.9 vs 19.3%, $P < 0.001$). Overall in-hospital mortality was 4.2% (SEA 3.9 vs EUR 4.5%, $P = 0.77$).

Discussion

This study has provided a rare opportunity to explore the epidemiology, treatment and outcome of patients

Table 2 Clinical features at admission

	Total	AANZDEM	Missing data	EuroDEM	Missing data	*P*-value
Vital signs at admission						
SBP, median (IQR) (mmHg)	140 (120–156)	139 (120–157)	13	140 (120–155)	6	0.72
SBP < 100 mmHg, *n* (%)	22 (2.8)	9 (2.2)		13 (3.4)		0.4
Heart rate, median (IQR) (b.p.m.)	62 (82–110)	99 (84–112)	12	95 (80–109)	8	0.008
Heart rate > 120 b.p.m., *n* (%)	105 (13.4)	61 (15.1)		43 (11.4)		0.15
Respiratory rate, median (IQR) (cycles/min)	24 (20–28)	25 (22–30)	18	24 (20–28)	69	<0.001
Respiratory rate > 30 cycles/min, *n* (%)	123 (17.3)	74 (18.6)		49 (15.5)		0.31
SpO_2 < 90% on air†, *n* (%)	182 (27.2)	87 (30.2)	127	95 (25)	6	0.19
Temperature <35 or >38°C, *n* (%)	55 (7.3)	32 (8.2)	23	23 (6.4)	29	0.46
pH, *n* (%)						
Blood gas taken	504 (62.9)	229 (51.2)	—	275 (71.2)	—	<0.001
pH <7.3	66 (8.2)	38 (9.2)	—	28 (7.3)	—	0.4

†Excludes patients arriving on oxygen. IQR, interquartile range; SBP, systolic blood pressure; SpO_2, arterial blood oxygen saturation.

Table 3 Management at the emergency department (ED) and outcomes

	Total	AANZDEM	Missing data	EuroDEM	Missing data	*P*-value
Treatment in the ED, *n* (%)						
Oxygen therapy						
Low flow O_2 (nasal prongs or Venturi system)	421 (53.3)	237 (57.2)	4	184 (45.5)	7	<0.001
High flow face mask	119 (15.1)	33 (8)		86 (22.7)		
None	170 (21.5)	99 (24.1)		71 (18.7)		
NIV combined	81 (10.2)	46 (11.1)	0	35 (9.2)	7	0.46
NIV if pH <7.3	40 (60.6)	22 (57.9)	0	18 (64.3)	0	0.79†
Mechanical ventilation	6 (0.8)	4 (1.0)	0	2 (0.5)	7	0.76
Inhaled beta-2 agonists	636 (79.4)	332 (80.4)	2	294 (78.4)	11	0.55
Inhaled anticholinergic	423 (54.1)	226 (54.7)	2	197 (53.4)	17	1
Inhaled bronchodilator (beta-2 agonist, anticholinergic or both)	633 (80.3)	332 (80.4)	2	301 (80.2)	11	1
Corticosteroids (i.v. or oral)	463 (59.5)	271 (65.3)	2	192 (52.6)	21	<0.001
Antibiotics	347 (44)	200 (48.5)	3	147 (40.2)	20	0.02
Discharge from the ED, *n* (%)						
Home	211 (26.4)	80 (19.3)	0	131 (34)	1	<0.001‡
Ward (including transfer for admission)	543 (67.9)	306 (73.7)	0	237 (61.6)	1	
Intensive care unit	44 (5.5)	28 (6.7)	0	16 (4.2)	1	
Death in ED	2 (0.2)	1 (0.1)	0	1 (0.3)	1	
In-hospital outcome, *n* (%)						
Mortality	32 (4.2)	16 (3.9)	0	16 (4.5)	33	0.77

†Fisher's exact test. ‡Omnibus Chi-squared. BiPAP, bilevel positive airway pressure; CPAP, continuous positive airway pressure; IV, intravenous; NIV: non-invasive ventilation.

presenting to ED with a final ED diagnosis of COPD, to determine compliance with guideline recommended treatment and to compare management and in-hospital outcomes across two major regions. Our findings suggest that compliance with guideline recommended treatment is sub-optimal in both regions and that ED could do more to improve quality of care for this patient group.

While the use of inhaled beta agonists was similar, it is lower than expected. The proportion of patients receiving systemic corticosteroids was considerably below expected levels. COPD guidelines recommend systemic corticosteroid for non-mild exacerbations of COPD as they reduce severity and shorten recovery.[8,10] Overall, almost 40% of patients did not receive them, with EUR compliance being significantly lower than SEA. Previous research suggests that the proportion of patients with COPD who have clinical, investigatory or radiological evidence of infection is 65–70%.[11] That only 43.3% of patients received antibiotics falls well below what would be expected on the basis of that data. That said, the features used to define evidence of potential bacterial infection in that paper are liberal and some could apply to viral and well as bacterial infection. For this reason, we are unable to comment further on whether the reported rate of antibiotic use was appropriate. The proportion of patients with acidosis who received treatment with NIV was also lower than expected, despite level 1 evidence that it improves outcome.[12] We did not collect reasons for non-use of NIV. Based on our experience and knowledge of the sector, possible explanations include lack of awareness of the evidence, lack of availability of the required equipment in ED and lack of appropriately trained staff to undertake this therapy safely in ED. Other contributors may have been that the patient declined NIV or under-estimation of severity by treating clinicians.

The results of our study do not compare favourably with a published European audit of management of COPD admissions.[13] That study reported that 91% of patients received short-acting bronchodilators, 82% received systemic corticosteroids and 91% of eligible patients received antibiotics, all much higher than this study. Our study found a higher use of NIV in patients with respiratory acidosis (61 vs 51%). The comparisons should be considered cautiously however as that study was of patients admitted to hospital rather than presenting to ED – a quite different clinical practice environment. It seems logical that evidence-based care should be initiated as early as possible in a patient's journey. The evidence suggests there may be a disjunct between ward-based pathways and ED pathways for this patient group, a gap that should be closed. The European audit[13] also reported variation in guideline compliance between countries and hospitals. In our study, the aggregation of data into regions may obscure site-to-site or country-to-country variation within regions. Numbers at individual sites within our study were too small for comparative analysis. That said, we believe that lessons from regions form an important step in understanding widespread gaps in guideline compliance. They inform individual health services and hopefully encourage them to audit their own practice and implement quality improvement activities with an emphasis on the identified gaps.

Our study did not explore treatment decision-making. Contributing factors to non-compliance with guideline recommendations may include lack of awareness of the evidence, the cognitive overload associated with ED practice, time constraints in ED, distraction and competing patient priorities as several patients may be being processed by a doctor at any given time and the historically high turnover of ED staff making it difficult to ensure that all staff are educated in evidence-based recommendations and recent changes. One approach suggested to address deficits in care is the introduction of a COPD proforma or checklist. Using this approach, Sen *et al*. demonstrated improvements in categorisation of respiratory failure, administration of controlled oxygen therapy and appropriate referral for NIV.[14] Similarly, McCarthy *et al*. showed that a proforma improved compliance with defined treatments.[15] This approach may be effective because it makes doctors aware of, or reminds them about, guideline-based care. Since the healthcare world is moving towards paperless systems, the use of clinical informatics systems, such as computer-assisted decision support will probably be required. Such systems have been proven to improve patient safety and have been recommended by the US Agency for Healthcare Research and Quality.[16]

The marginally higher EUR in-hospital mortality may simply be a reflection that there was higher tolerance for ED discharge of patients with moderate exacerbations of COPD in EUR. It may also have been influenced by higher smoking rates and higher proportion of patients with heart disease. We cannot confirm this.

The disparities in admission rate (SEA being much higher) are striking. There may be several reasons for this. When deciding whether hospital admission is required, a range of factors is taken into account, including patient factors (e.g. health literacy and ability to self-manage), illness severity, social factors, use of disease specific ED short stay unit pathways and access to appropriate follow-up care (such as primary care or specialist clinics, disease-specific outreach services, etc). We are unable to comment which of these might have contributed to the observed disparity. The difference does raise the possibility that there were unnecessary admissions in

the SEA cohort, which may be an area worthy of more research.

The higher proportion of current smokers in the EUR cohort is noteworthy. It suggests that there is opportunity to improve long term outcomes by targeting smoking cessation. Many areas in SEA have been aggressive in bureaucratic attempts to encourage smoking cessation, such as taxing cigarettes, requiring plain unattractive packaging, requiring health warnings (and sometimes photos of complications) on cigarette packets, banning smoking in restaurants and some public areas and requiring cigarettes to be stored out of sight in retail outlets.[17,18] Measures such as these may also be generalisable to Europe.

Our study confirms that shortness of breath is a high risk presenting complaint for in-hospital mortality. We report in-hospital mortality of 4.2% which is similar to previously reported mortality rates in COPD exacerbations.[19–21]

The finding that only about a third of patients are current or recent smokers is interesting and COPD is uncommon in non-smokers. The design of our study did not allow us to collect detailed data regarding patients' smoking pack-year history. This is likely to have shown that the majority of patients had a significant history of smoking even if not smoking recently.

Our study has some limitations that should be considered when interpreting our results. There was no central committee for the adjudication of final diagnosis. It was based on final ED diagnosis, representing the 'real world' of emergency medicine practice. This is to an extent is offset by a large sample size suggesting generalisation of findings. Local data collectors were provided with detailed data collection information (including a data dictionary) therefore minimising bias. We did not distinguish between acute exacerbations, therapeutic failure and relapse. In Emergency Medicine practice, distinguishing these is not clinically relevant. We did not formally assess severity. That said, vital signs observations and the proportion of patients with significant acidosis were not statistically different between the groups. The nature of ED practice means that some data that lung specialists rely on to confirm the diagnosis of COPD and severity of illness are not available. For example, dyspnoea scores and spirometry are rarely used in ED. It is possible that compliance with guideline recommended treatments in the EuroDEM sample has been under-estimated. Some patients who presented to hospital through ambulance in the EuroDEM may have had treatments initiated by paramedics/physicians in the ambulance which were not captured by data collection processes. It is a potential limitation that only about 90% of patients had a previous known diagnosis of COPD. Again, this reflects the 'real world' situation of emergency care. Further, a significant proportion of the remainder reported a past history of asthma, possibly reflecting difficulty distinguishing between these, especially in mid-late age. To test the bias this might have introduced, we repeated the analysis for the patients with previous COPD only and the results were not substantially different (Supporting Information Tables S1–S3). There is a small amount of missing data that may have influenced results with the amount of missing data is higher in the European sample than the SEA sample. While it is unlikely that data is missing completely at random, it is very small relative to the sample size. There is the potential risk of inclusion and registration bias. Given the nature of this study it is not possible to qualify the risk of this bias. Finally, the sites contributing data were not selected at random. Rather than chose to participate voluntarily. Therefore it is possible that they are not representative of their regions. However, this is a weakness shared with many similar audit of care studies and is hard to avoid.

Conclusion

Compliance with guideline recommended treatments, in particular administration of corticosteroids and NIV, was sub-optimal in both regions. Improved compliance has the potential to improve patient outcome.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web-site:

Table S1. Patient characteristics for cohort with previously diagnosed COPD.
Table S2. Clinical features at admission for cohort with previously diagnosed COPD.
Table S3. Management at the ED and outcomes for cohort with previously diagnosed COPD.

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Post-stroke sleep disturbances and rehabilitation outcomes: a prospective cohort study

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poor sleep, stroke, rehabilitation outcome, length of stay.

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Abstract

Background: Poor sleep is common after stroke, and data regarding its effect on rehabilitation outcomes are limited. Controversial evidence was found concerning the effect of sedatives on improving sleep quality in poor sleepers after stroke.
Aim: To assess the prevalence of poor sleep in post-stroke patients and its effect on rehabilitation outcomes.
Method: A total of 104 stroke patients from two major stroke rehabilitation units in Western Australia was enrolled. Sleep quality was assessed using the Pittsburgh Sleep Quality Indexes at baseline and after stroke. The main outcome measures were Functional Independence Measure (FIM) change and length of stay (LOS). Sedative use during this period was also recorded.
Results: A total of 29.8% post-stroke patients suffered from poor sleep. There was no relationship between poor sleep and the stroke characteristics, such as severity, side and type, or demographics, such as age and gender. Poor sleep quality was inversely associated with rehabilitation outcomes measured by FIM (Rs. −0.317, $P = 0.005$). However, there was no significant association between sleep quality and LOS ($P = 0.763$). Sedatives were used in 18.2% of patients but had no impact on sleep quality or rehabilitation outcomes.
Conclusion: This research supported that poor sleep was frequent after stroke and had negative effects on rehabilitation outcomes. Use of sedatives was of limited benefit to improve sleep quality, and further studies are required to search for strategies to improve sleep problems after stroke.

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