Survival and quality of life for patients with COPD or asthma admitted to intensive care in a UK multi-centre cohort: the COPD and Asthma Outcome Study (CAOS)

Martin J Wildman, Colin Sanderson, Jayne Groves, Barnaby C Reeves, Jon G Ayres, David Harrison, Duncan Young, Kathy Rowan

Corresponding author
Dr Martin J Wildman, Sheffield Thoracic Institute, Northern General Hospital, Herries Road, Sheffield S5 7AU
Telephone 0114 2714770
Fax 0114 2266280

Co-Authors
Dr Colin Sanderson, Health Services Research Unit, London School of Hygiene & Tropical Medicine, London UK.
Ms Jayne Groves, Heartlands Hospital, Birmingham, UK
Prof Barnaby Reeves, Health Services Research Unit, London School of Hygiene & Tropical Medicine, London UK
Prof Jon G Ayres, Department of Environmental & Occupational Medicine, University of Aberdeen, UK
Dr David Harrison, Intensive Care National Audit and Research Centre, London UK
Dr Duncan Young, Nuffield Department of Anaesthetics, Oxford, UK
Dr Kathy Rowan, Intensive Care National Audit and Research Centre, London UK

Key Words
COPD, Survival, Quality of life

Abstract

Background Non-invasive ventilation is first-line treatment for patients with acutely decompensated chronic obstructive pulmonary disease (COPD), but endotracheal intubation, involving admission to critical care, may sometimes be required. Decisions to admit to critical care are commonly based on predicted survival and quality of life, but the information base for these decisions is limited, and there is some evidence that clinicians tend to be pessimistic. We studied outcomes in COPD patients admitted to critical care for decompensated type II respiratory failure.

Methods A prospective cohort study was carried out in 92 intensive care and 3 respiratory high dependency units in the United Kingdom. Patients aged 45 years and older with breathlessness, respiratory failure or change in mental status due to an exacerbation of COPD, asthma or a combination of the two were recruited. Outcomes included survival and quality of life at 180 days.

Results Of the 832 patients recruited 517 (62%) survived to 180 days. Of the survivors, 421 (81%) responded to a questionnaire. Of the respondents, 73% considered their quality of life to be the same as or better than it had been in the stable period before they were admitted, and 96% would choose similar treatment again. Function during the stable pre-admission period was a reasonable indicator of function reported by 180-day survivors.

Conclusions Most patients with COPD who survive to 180 days after ICU have a heavy burden of symptoms but almost all of them, including those who have been intubated, would want similar intensive care again under similar circumstances.

Introduction.

An acute exacerbation of cnronic obstructive pulmonary disease (COPD) is a common reason for hospital admission, and although non-invasive ventilation is the recommended first line treatment for decompensated type II respiratory failure, on occasions endotracheal intubation may be required[1]. Decision making about intubation should involve some understanding of the likely probability of survival, and also of the quality of life that survivors can expect. This information will be most useful if it comes from systematic studies of survivors, who provide both assessments of their own quality of life and their views about the acceptability of their treatment. There are some data from the USA[2] but very few from the UK, which has historically had fewer ICU beds per unit population and may have different admission policies and practices. A simulation study carried out in one Critical Care Network in the UK suggested that for COPD patients with a given set of characteristics and preferences, and subject to identical resource constraints, there was variation in decision making about whether intubation was appropriate, partly because of widely differing estimates of the probability of survival[3]. However an analysis of actual decision making in the UK suggested that clinicians tended to be pessimistic about survival[4]. In order to provide both clinicians and patients with better information about outcomes for COPD after critical care, this study reports the survival, quality of life and future treatment preferences of patients in the COPD and Asthma Outcome Study (CAOS) study.

Methods.

Intensive care units and subjects

All intensive care units (ICUs) participating in the UK Case Mix Programme (CMP)[5], and 3 respiratory high dependency units in hospitals with ICUs, were invited to take part. Patients were eligible if they were admitted to a participating unit with breathlessness, respiratory failure or change in mental status due to an exacerbation of obstructive lung disease. They were recruited on admission to the unit. Clinicians were asked to classify the patient as having either COPD, asthma or a mixture of the two because the precise classification of obstructive airways disease can be difficult at the time decisions about admission to ICU have to be made, but even an imprecise diagnosis may have prognostic value. Clinicians found this classification easy to use in the clinical setting.

Patients under the age of 45 were excluded as it was expected that they would be admitted irrespective of prognosis. Patients were also excluded if they had had surgery within the past 10 days or had been transferred from another hospital. Data were collected for admissions between March 2002 and September 2003 with follow-up for 180 days after ICU admission. The study had Multi-Centre Research Ethics Committee approval.

Data collected

Data were sought about each patient's function during the period of stability two weeks before admission using a 4-point scale[6], and standard questions were asked about activities of daily living[7]. Clinicians were asked to use the EuroQol visual analogue score (VAS)[8] to predict the patients self-rated quality of life at 180-days if they were to survive .

When a patient was discharged from a unit or died while in it without having been intubated, clinicians were asked whether intubation had been ruled out as a treatment option if medical treatment and NIV were to fail or had failed**.** This information was used to divide the patients into 3 'intubation status' groups: intubation not needed, intubated, and not-to-be-intubated.

This last group included both those for whom clinicians felt intubation to be futile and patients who declind treatment escalation.

Actual survival to 180 days was determined initially from the general practitioner, and confirmed by the Office of National Statistics. A follow-up questionnaire was sent to 180-day survivors which included the 4-point functional score used on admission, the Euroqol profile and VAS, the AQ-20[9], and how their current state of health compared to their health during the period of stability prior to hospitalisation. Also to understand how patients felt about their experience of ICU and intubation they were asked "under the same circumstances, would you be willing to undergo similar intensive care treatment again?"

Data for the participating critical care units and others were also obtained from the CMP database.

Analysis

Data from the study were compared with extracts from the CMP database to assess how representative of the UK the IC/HD units and patients recruited were. Data from the CMP were also used to indicate the variation between units in admission policies.

Survival rates and quality of life on follow-up were examined overall and for the three 'intubation status' groups. Clinicians' predictions of quality of life among 180-day survivors were compared with the survivors' assessments, and functional status in the 2 weeks prior to admission was compared with survivors' reports.

Analyses were carried out using Stata version 9 (Stata Corp, College Station, Texas).

Role of the funding source

The funder had no role in the design, analysis, interpretation or reporting of this research.

Results

Units and patients recruited

Of the 239 intensive care units in the UK in January 2002, the 177 contributing to the Case Mix Programme database at the time were invited to take part. Three turned out to be ineligible because they were specialist units that never admitted COPD patients, 73 refused, 3 never completed the ethics process and 6 recruited no patients. This left 92 ICUs actively participating, 38.5% of the units in the UK and 52.0% of those invited. Three respiratory critical care units also participated.

For 89 of the 92 ICUs data were available from the CMP database that allowed comparison with non-participating units. The units actively participating were similar to others in terms of type, size and affiliation, and the mean percentages of admissions potentially eligible for the study (Table 1). The CMP database also allowed comparisons of the patients recruited with those eligible but not recruited in the participating units (Table 2). There were 832 patients recruited, 724 to ICUs and 108 to respiratory HDUs. At the time of these analyses there were data in the CMP dataset for 648 of the 724 (94.5%). These 648 were compared with the 996 patients in the dataset admitted to participating ICUs and satisfying the inclusion criteria but not recruited. There were no differences in terms of age (z-test p=0.49), COPD acute physiology score[10] (z-test p=0.96), or ICU survival (chi-square 0.77 p=0.38).

The CMP database had data on 8717 patients meeting the CAOS study inclusion criteria and admitted between 2000 to 2006 to the ICUs in the CAOS study. The participating centres are

plotted from left to right by increasing mean age (Figure 1) and by increasing percentage of admitted patients in the most limited classification of baseline respiratory impairment in APACHE II. (Figure 2). These diagrams suggest between-unit variation in the age and fitness of patients admitted. This may be partly due to variation between catchment populations, but it also suggests that some units are more selective than others about which patients with COPD/asthma they admit.

Ventilation and length of stay

Of the 832 patients recruited, 81.3% were admitted only to ICU. 54.1% were intubated before or during ICU admission, 36.5% were not intubated but had non-invasive ventilation, and 8.1% had medical treatment only. For 201 (53%) of the unintubated patients medical treatment and non-invasive ventilation were sufficient to manage the exacerbation ('intubation not needed'), but in the other 47% the patients were designated 'not to be intubated'.

Baseline differences between intubation status groups are given at the top of Table 3. In the intubated and intubation-not-needed groups the patients have been subdivided into those with COPD or a mixture of COPD and asthma (labelled 'COPD ±') and those diagnosed on admission as 'pure asthma'. (In the not-for-intubation group there were only 2 pure asthmatics, and only one who responded to the 180-day questionnaire, so this group was not subdivided.) In this table as elsewhere, the numbers in the intubation-not-needed/pure asthma subgroup were small, and so the parameter estimates will be very imprecise. Of the patients designated 'not to be intubated' 57% had been admitted directly to ICU. They tended to be older than the others (mean age 70.3 vs. 66.1 years, t-test $p<0.001$), and had slightly lower mean CAP scores (26.4 vs. 28.4. t-test $p=0.03$). They had much lower functional scores (housebound or worse 68.0% vs. 30.0%, chi-square $p<0.001$), and 75.1% were either housebound or on long-term oxygen or both, compared to 32.7% in the intubated group.

The intubated patients had longer stays than the others, both in the COPD ± in the pure asthma subgroups.

Survival

Survival rates at discharge from the ICU and from hospital, and at 180 days after ICU admission are given in Table 3. Overall 517 (62.1%) survived to 180 days. Survival rates were highest in patients who did not need intubation. They were lowest in those designated 'not for intubation', but the differences in survival between the intubated and the not-to-be-intubated groups were not significant. The intra-class correlation for actual survival rates between participating units was 0.017 (95% CI 0.000 to 0.057) so no adjustment was made to the confidence intervals for unit-level effects.

Quality of life at 180 days

Of the 517 180-day survivors, 420 (81.4%) returned the follow-up questionnaire. The median (IQR) time from critical care admission to return of questionnaire was 231 days (200 to 399). There was no difference in the percentage of survivors returning the questionnaire between the five groups examined (Table 4 available on the web). In comparing their current state of health to how it had been before hospitalisation, overall 73% said it was the same or better. The corresponding figures for the 184 prompt responders (<220 days after admission), the 179 delayed responders (221-365 days) and the 57 very delayed responders were 71%, 75%

and 70%, giving no indication that non-responders might have reported markedly differently (p for Chi-square = 0.81).[11]

Table 4 also gives results from the EuroQol schedule. For example 62% of the respondents experienced moderate or extreme discomfort; 56 % had some anxiety/depression, 7% rating this as extreme. Generally quality of life in the not-to-be-intubated group was poorer than for the rest. On the EuroQol VAS (0 = "worst possible health state", 100 = "the best imaginable health state"), the overall mean rating (SD) was 54.9(19.5); 75% rated their health state as at least 40 and 50% rated it as at least 50.

The AQ-20 questionnaire gives more detail about the symptoms associated with airways disease, and Table 5 available on the Web summarises the data from the 420 respondents. The question on doing things at work was only answered by 59 people so the results are unreliable and are only included for completeness. The p-values are for Chi-square tests of the hypothesis of no difference in the percentages between intubation status groups. 42.7% of the respondents reported feeling breathless when trying to get to sleep. Only 16% of those who considered the question applicable could get upstairs without breathlessness, 74% had difficulty getting around the house because of their chest trouble, and 83% felt that the fullness of their lives was limited by their chest troubles. For the AQ20 score, which has a range of 0 to 20, the mean (SD), and median (IQR) scores were 11.2 (4.7) and 12 (8-15).

Willingness to undergo similar treatment in the future

In spite of this burden of symptoms and disabilities, of the 415 who answered the question about whether they would be willing to undergo similar treatment again under the same circumstances, 96% said that they would. In the 212 intubated patients the percentage was the same. Even under the worst-case assumption that all non-responders would not want ICU admission again, 204 out of the 263 who survived to 180 days (78%) would have wanted it. There was no significant difference in this respect between patients with COPD ± and those in the 'pure asthma' category.

Predictors of quality of life on follow-up.

Patient-reported function in the follow-up questionnaire was slightly worse at 180 days than pre-admission function collected from either the patients themselves (45%) or other witnesses (55%) at admission to critical care. Overall about a half scored the same, about a third were worse and about a sixth were better. More detail on the changes in reported function for each pre-admission functional category are given in Table 6. The actual agreement between function before ICU and on follow-up was quite low (kappa = 0.21, $p < 0.0001$) but the correlation between the two (and therefore the discriminatory power of pre-admission function) was reasonably good (Spearman's 0.485, $p < 0.0001$), so pre-admission functional status gives clinicians useful information about likely status on follow-up. As a rule of thumb, those who were housebound pre-admission will probably be the same at follow-up, but the most common (and equally likely) outcomes for those who were fully mobile or independent is that they will stay the same or drop one category.

Doctors' predictions of quality of life at 180 days made on admission using the EuroQol visual analogue scale (VAS) were slightly pessimistic when compared with the patients' reported scores in the follow-up questionnaire (mean predicted score 50% compared to 55%). In spite of using 100 scale points rather than the 4 on the function scale, discrimination was relatively poor (Spearman's 0.221, p = 0.0004). Agreement after converting both VAS scores into quartiles was also poor (kappa = 0.052, p = 0.032).

Discussion.

Limitations

This study recruited patients with COPD, asthma or a mixture of asthma and COPD who were admitted to UK ICUs or HDUs with an episode of respiratory failure. The participating units and patients recruited appear to be representative of UK practice, and the rate of follow-up was good. In these respects the results should be generalisable and valid within the UK at least.

Importantly however, all the patients in this study were selected for either ICU or HDU admission. Of the whole 'population' of patients admitted to hospital with severe acute exacerbations of COPD, we would expect to have recruited relatively few on long-term oxygen and/or with low functional scores. (In one centre 48.9% of all hospitalised COPD patients were housebound or worse, compared to 38.2% in this study.[12]) Thus our overall results may be least applicable to such patients. However Figure 1 suggests that the units taking part in the study had highly variable admission thresholds. The spectrum of those recruited, if not representative overall, was broad, with substantial numbers of patients with low functional scores, especially in the 'not-to-be-intubated' group. Results for subgroups are therefore of interest.

Assignment of the patients to diagnostic groups was based on clinical judgement at the time of admission. We cannot be certain that those classified as 'pure asthma' really did have asthma or whether some of the younger patients for example were in fact COPD. However the 180-day survival rate for the COPD ± group was about 60% compared to around 90% for the 'pure asthma' group. Also these diagnostic categories were significant predictors of prognosis in a multivariate prognostic model that took account of factors such as age and functional status[13].

Comparison with other studies

On a scale of 0 to 100, survivors' mean rating of their overall quality of life was 54.9, significantly less than VAS scores for members of the public in the 65 to 74 year old age group (mean 77.3[14]) but similar to the score of 50.9 (SD 16.4) for 132 COPD outpatients with a mean age of 67 and mean FEV1 of 47% attending a chest clinic[15].

Although they reported widespread discomfort and disability, around 75% of the responding survivors considered their quality of life to be similar to or better than it had been in the stable period before they were admitted, and over 95% of them would choose similar treatment again. This is broadly consistent with the results of an earlier study in which 87% of 81 COPD patients with mean age 75 said they would accept a 'high burden' of treatment if it was life-saving and restored current health.[16]

In an earlier analysis we found that clinicians appeared to be pessimistic about the probability of survival of COPD patients on admission to ICUs[4]. This was also found in the SUPPORT study[2]. Here we report that clinicians' predictions of the quality of life of survivors were undiscriminating as well as slightly pessimistic, but that functional status in the period of stability 2 weeks before ICU admission was a reasonable discriminator, if a slightly optimistic predictor, of function in the longer term. Again, these findings are consistent with results from other studies. Frick et al in the USA found that neither doctors nor nurses could

predict outcomes well[17], and the SUPPORT study showed that functional status before ICU admission was a better indicator of longer-term function than doctors' predictions[18].

Conclusion

This is the largest study to have systematically collected data on outcomes for patients with airway obstruction admitted to critical care units in the UK. Over 60% survived for at least 180 days after ICU admission, and even among the relatively sick group that were 'not to be intubated', 180-day survival was almost 50%. Functional capacity in the period of stability in the two weeks before hospital admission is a reasonably discriminating indicator of function at 180 days. And although survivors still had impaired quality of life, almost all of them would have wanted similar treatment again. We think that these findings should inform decision making for patients who are being considered for intubation.

We thank all the CMP units that participated in the study for recruiting the patients to make the study possible. We also thank the Intensive Care National Audit and Research Centre for their invaluable role in recruiting units and data linkage. We thank Jan Van Der Meulen for advice on the data analysis.

Contributors: MJW, CS, KR, JA, BR and DY were involved in the original design of the study. MJW co-ordinated the study, and carried out the initial data analysis and drafting of the paper. JG helped to collect the data. CS carried out additional analyses and drafted the final paper. KR and DH helped recruit the units and facilitated data linkage with the CMP. All the authors revised the manuscript critically for important intellectual content and approved the final version. MW is the guarantor. There are no competing interests declared.

Funding. MW was funded by an MRC Health Services Research Fellowship. JG was funded by an NHS R & D grant.

Table 1: Intensive care units in the Case Mix Programme participating and not participating in CAOS (CMP data)

		Participating	*Not participating*
	Total number of units	89 (100%)	76 (100%)
Type of unit	ICU	41 (46.1%)	27 (35.5%)
	ICU/HDU	42 (47.2%)	39 (51.3%)
	Other	6 (6.7%)	10 (13.2%)
Number of beds	3-5	21 (23.6%)	15 (19.7%)
	6-9	43 (48.3%)	41 (53.9%)
	10+	25 (28.1%)	20 (26.3%)
In university or affiliated hospitals		35 (39.7%)	32 (42.1%)
Admissions per unit per year		470	454
Total admissions during study period (= n_1)		39,309	46,258
Admissions potentially eligible for study	n_2 (% of n_1)	1,543 (3.9%)	1,501 (3.2%)
	Mean CAPS[1] (sd)	33.6 (12.0)	35.1 (12.5)
	ICU survival (% of n_2)	1,223 (79.3%)	1,138 (75.8%)

1. COPD acute physiology score

Table 2: Potentially eligible patients in participating units recruited and not recruited (CMP data)

	Recruited n = 648		*Not recruited* n = 996	
	Mean	*SD*	*Mean*	*SD*
Age	66.2	9.9	66.8	10.2
COPD acute physiology score	33.9	12.2	33.9	12.1
Gender male	48.8%		49.2%	
Admission out of hours (18:00–08:00)	49.7%		52.8%	
Admission at weekend	26.7%		26.7%	
ICU survival	80.6%		78.2%	

Table 3: Recruitment, baseline values, ventilation, survival and questionnaire response

		Intubation not needed		*Intubated*		*Not to be intubated*	*Overall*	p[6]
		COPD ±	*'pure' asthma*	*COPD ±*	*'pure' asthma*			
	n recruited	179	22	394	56	181	832	
% admitted directly to ICU[1]		60.3	77.3	99.5	100.0	56.9	81.3	
On admission	Age: mean (std)	67.7 (9.2)	59.1 (10.6)	66.8 (8.9)	57.9 (9.7)	70.3 (9.4)	67 (9.7)	
	CAPS[2] mean (std)	23.9 (9.9)	22.4 (10.6)	31 (10.8)	26.4 (9.8)	26.4 (10.2)	27.9 (10.8)	
	MAC[3]: mean (std)	27.7 (5)	31.4 (5.2)	28.9 (5.2)	30.5 (5.3)	27.4 (5.9)	28.5 (5.4)	
	% house/bedbound	34.6	13.6	31.2	12.5	67.4	38.1	
	% long-term oxygen[4]	12.9	9.1	10.4	5.4	38.1	16.6	
Ventilation	% non-invasive only	74.7	13.6	0.0	0.0	91.7	36.6	< 0.0001
Length of stay	In ICU, median (IQR)	3 (1.5, 5)	2 (1, 3)	9 (4. 16)	6.5 (3, 15)	3 (1, 4)	4 (2, 10)	0.0001
	In hospital, median (IQR)	12 (7, 19)	8.5 (6, 12)	20 (10, 36)	15 (8, 26)	10 (5, 17)	14 (8, 27)	0.0001
Survival[5]	% surviving IC/HDU	98.9 (96 to 99.9)	100 (84.6 to 100)	74.9 (70.3 to 79.1)	89.3 (78.1 to 96.0)	72.4 (65.3 to 78.7)	81.1 (78.3 to 83.7)	< 0.0001
	% surviving hospital	93.9 (89.3 to 96.9)	95.5 (77.2 to 99.9)	61.2 (56.2 to 66)	85.7 (73.8 to 93.6)	59.7 (52.1 to 66.9)	70.4 (67.2 to 73.5)	< 0.0001
	% surviving 180 days	81.6 (75.1 to 87)	95.5 (77.2 to 99.9)	54.6 (49.5 to 59.6)	85.7 (73.8 to 93.6)	48.1 (40.6 to 55.6)	62.1 (58.7 to 65.4)	< 0.0001

1. Not admitted to a Respiratory Support Unit at any stage
2. COPD acute physiology score
3. Mid-arm circumference
4. Oxygen concentrator at home before admission
5. (With exact 95% CIs)
6. Chi-square test for %s (independence in contingency tables); Kruskal Wallis for lengths of stay

Table 6: Function before admission and in the 180-day follow-up questionnaire

Function in 2 weeks before admission	*Function reported in 180-day questionnaire*				
	Fully mobile	*Independent*	*Housebound*	*Bed/ chairbound*	*Total*
Fully mobile	58 44.3%	49 37.4%	23 17.6%	1 0.8%	131 100.0%
Independent	26 16.3%	65 40.6%	67 41.9%	2 1.3%	160 100.0%
Housebound	7 5.8%	26 21.7%	74 61.7%	13 10.8%	120 100.0%
Bed/chairbound	0 0.0%	1 11.1%	7 77.8%	1 11.1%	9 100.0%
Total	91	141	171	17	420

References

1 National Institute for Clinical Excellence (NICE). Chronic obstructive pulmonary disease: national clinical guideline for management of chronic obstructive pulmonary disease in adults in primary and secondary care. *Thorax* 2004; 59: 152-154 (Suppl I).

2 Connors A, Dawson N, Thomas C et al. Outcomes following acute exacerbation of severe chronic obstructive lung disease. The SUPPORT investigators (Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments). *Am J Respir Crit Care Med* 1996; 154: 959-67.

3 Wildman M, O'Dea J, Kostopolou O, Tindall M, Walia S, Khan Z. Variation in intubation decisions for patients with chronic obstructive pulmonary disease in one critical care network. *Quarterly J Med* 2003, 96: 583-591.

4 Wildman, M, Sanderson C, Groves J et al. Implications of prognostic pessimism in patients with chronic obstructive pulmonary disease (COPD) or asthma admitted to intensive care in the UK within the COPD and asthma outcome study (CAOS): multicentre observational cohort study. *Brit Med J* 2007*;* 335: 1132-1135.

5 Harrison D, Brady A, Rowan K. Case mix, outcome and length of stay for admissions to adult, general critical care units in England, Wales and Northern Ireland: the Intensive Care National Audit & Research Centre Case Mix Programme Database. *Crit Care* 2004; 8:R99-111.

6 Menzies R, Gibbons W, Goldberg P. Determinants of weaning and survival among patients with COPD who require mechanical ventilation for acute respiratory failure. *Chest* 1989; 95: 398-405.

7 Katz S, Ford A, Moskowitz R, Jackson B, Jaffe M. Studies of illness in the aged – the index of ADL: a stndardized measure of biological and psychosocial function. *JAMA* 1963; 185: 914-919.

8 Brooks R, with the EuroQol Group. EuroQol: the current state of play. *Health Policy* 1996; 37:53-72.

9 Barley E, Quirk F, Jones P. Asthma health status measurement in clinical practice: validity of a new short and simple instrument. *Respiratory Med* 1998; 92:1207-1214.

10 Wildman M., Harrison D, Welch C, Sanderson C. A new measure of acute physiological derangement for patients with exacerbations of obstructive airways disease: The COPD and Asthma Physiology score. *Respiratory Med* 2007; 101: 1994-2002.

11 Hill A. General principles of field surveys. In: Medical Research Council. The application of scientific methods to industrial and service medicine. London: HMSO 1951: 16.

12 Wildman M, Groves J, Walia S et al. Hospitalised COPD exacerbations: Survival and univariate outcome predictors, 36 month follow-up. *Thorax* 2001: 56 (Supplement III): 19.

13 Wildman M, Sanderson C, Groves J et al. Outcome prediction for admissions with COPD to UK Critical Care units from CAOS: The COPD and Asthma Outcome study. *Thorax 2004:59 S39*

14 Kind P, Dolan P, Gudex C, Williams A. Variations in population health status: results from a United Kingdom national questionnaire survey. *Brit Med J* 1998; 316: 736-741

15 Harper R., Brazier J, Waterhouse J et al. Comparison of outcome measures for patients with chronic obstructive pulmonary disease (COPD) in an outpatient setting. *Thorax* 1997; 10: 879-87.

16 Fried T, Bradley E, Towle M, Allore H. Understanding the treatment preferences of seriously ill patients. *New Engl J Med* 2002; 346: 1061-6.

17 Frick S, Uehlinger D, Zuercher Zenklusen R. Medical futility: predicting outcome of intensive care unit patients by nurses and doctors - a prospective comparative study. *Crit Care Med* 2003; 31: 456-61.

18 Wu A, Damiano A, Lynn J et al.. Predicting future functional status for seriously ill hospitalized adults. The SUPPORT prognostic model. *Ann Intern Med* 1995; 122: 342-50.

Figure 1

Figure 1:

Mean age and 95% confidence limits of COPD patients admitted to the critical care units involved in the CAOS study, during the period between 2000 to 2006 (n=8717)

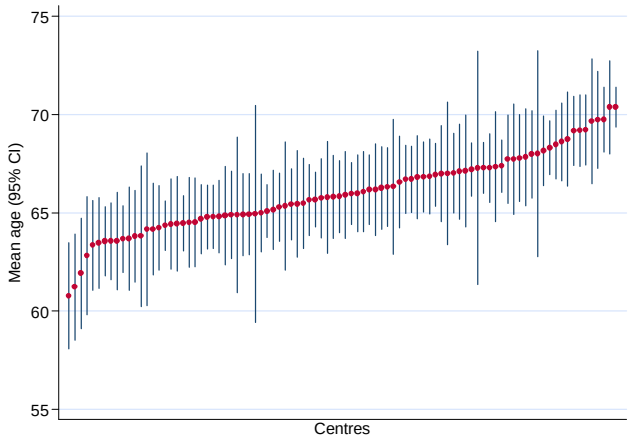

Figure 2

Figure 2:

Percentage of patients (95% confidence limits) with COPD and severe respiratory disease in the period of stability prior to admission, for the critical care units participating in the CAOS study, during the period between 2000 and 2006 (n=8717)

Severe chronic respiratory disease is “permanent shortness of breath with light activity due to pulmonary disease. Functionally, this patient is unable to work and has shortness of breath performing most normal activities of daily living, for example, walking 20 metres on level ground, walking slowly in the house, climbing one flight of stairs, dressing or standing”

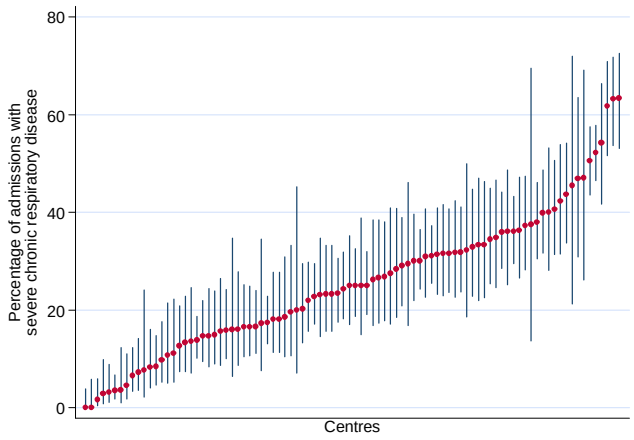

Table 4: Euroqol and other outcomes reported by 180-day survivors

		Intubation not needed		*Intubated*		*Not to be intubated*	*Overall*	*p*[3]
		COPD ±	*'pure' asthma*	*COPD ±*	*'pure' asthma*			
	number responding	120	16	171	42	71	420	
	% survivors responding	82.2	76.2	79.5	87.5	81.6	81.2	0.719
EQ[1] thermometer score	Mean (SD)	53.9 (19.8)	52.9 (18)	57.2 (18.2)	61 (22.1)	47.6 (18.8)	54.9(19.5)	0.613
	Median (IQR)	50 (40, 66)	50 (40, 64)	55 (45, 70)	60 (45, 80)	50 (30, 63)	50 (40, 70)	
EQ-5D[2]	Mean (SD)	52.3 (32.5)	59.3 (26.9)	59.6 (26.7)	60.6 (37.2)	41.6 (31.4)	54.6(31.0)	0.141
	Median (IQR)	62 (36, 74)	69 (55, 73)	69 (52, 78)	67 (52, 85)	52 (19, 64)	62 (35, 74)	
EQ Mobility	% no problems walking	18.3	12.5	17.2	40.5	2.8	17.2	< 0.0001
	% some problems walking	80.0	87.5	82.3	59.5	94.4	81.6	
	% bed bound	1.7	0.0	0.6	0.0	2.8	1.2	
EQ Self care	% no problems	46.7	75.0	57.4	66.7	25.4	50.5	< 0.0001
	% some problems	50.8	25.0	39.6	28.6	54.9	43.8	
	% can't wash/dress	2.5	0.0	3.0	4.8	19.7	5.7	
EQ Usual activities	% no problems	14.2	18.8	20.7	42.9	7.0	18.7	< 0.0001
	% some problems	65.0	68.8	59.2	42.9	60.6	59.8	
	% cannot do	20.8	12.5	20.1	14.3	32.4	21.5	
EQ Pain/ discomfort	% none	39.2	31.3	42.6	38.1	28.2	38.3	0.11
	% moderate	50.8	56.3	55.0	57.1	62.0	55.3	
	% extreme	10.0	12.5	2.4	4.8	9.9	6.5	
EQ Anxiety/ depression	% none	36.7	68.8	47.9	52.4	31.4	43.2	0.084
	% moderate	51.7	25.0	47.3	38.1	61.4	49.2	
	% extreme	10.8	6.3	4.7	9.5	7.1	7.4	
Functional score	% fully mobile	17.5	18.8	26.3	45.2	4.2	21.7	< 0.0001
	% independent	38.3	50.0	36.3	19.1	23.9	33.6	
	% housebound	37.5	31.3	36.8	35.7	60.6	40.7	
	% bedbound	6.7	0.0	0.6	0.0	11.3	4.1	
Compared to health before hospitalisation	% much worse	14.2	25.0	7.7	0.0	9.9	9.8	0.002
	% a little worse	17.5	12.5	17.1	9.5	22.5	17.2	
	% the same	20.8	31.3	17.1	19.1	18.3	19.1	
	% a little better	14.2	25.0	23.5	42.9	32.4	24.3	
	% much better	33.3	6.3	34.7	28.6	16.9	29.6	
Would choose ICU again?	% yes	98.3	100.0	95.3	100.0	91.3	96.2	0.113

1. EQ indicates that the data are from the EuroQol questionnaire.
2. EQ-5D is a weighted index derived from each patient's score in the five EQ domains
3. Chi-square for comparisons of %s, F from analysis of variance for comparison of means.

	n of responses	*% of responses with data*	*p*

Table 5: AQ-20 scores reported by 180-day survivors

Question	Missing	Not appl.	With data	Intubation not needed		Intubated		Not to be intubated	Overall	
				COPD ±	'pure' asthma	COPD ±	'pure' asthma			
Do you cough during the day?	2	3	415	57.1	62.5	55.3	48.8	55.1	55.4	0.878
Does your chest often make you feel restless?	5	2	413	73.7	66.7	60.4	50.0	78.3	66.3	0.005
Does gardening make you breathless?	4	157	259	88.7	72.7	81.1	77.4	94.3	84.2	0.151
Do you worry when going to a friend's house that there might be something there that will upset your chest?	2	55	363	41.6	46.7	40.9	36.6	40.4	40.8	0.969
Do you get chest problems when you come into contact with strong smells, exhaust fumes, perfumes etc?	3	10	407	82.1	81.3	78.7	81.0	74.6	79.4	0.821
Does your partner find your chest trouble upsetting?	2	169	249	68.7	71.4	68.5	65.5	71.1	68.7	0.992
Do you feel breathless when trying to sleep?	6	4	410	47.5	53.3	37.4	39.0	53.6	43.8	0.131
Do you worry about the long term effects of the drugs you take for chest trouble?	1	4	415	39.8	56.3	47.1	61.5	27.5	43.5	0.005
Does emotional upset make your chest trouble worse?	5	11	404	74.8	81.3	64.0	70.7	77.9	70.8	0.133
Are there times when you have difficulty getting around the house because of your chest trouble?	3	5	412	72.27	87.5	67.7	66.7	91.2	73.5	0.002
Does your chest problem make you breathless when you do things at work (if in paid employment)?	3	358	59	75.0	0.0	61.9	33.3	50.0	55.9	0.129
Does walking upstairs make you breathless?	2	47	371	89.2	81.3	82.1	64.1	96.6	84.4	0.0000
Do you get breathless doing housework?	3	96	321	85.6	85.7	81.8	63.9	93.8	82.8	0.008
Does your chest trouble make you go home sooner than others after a night out?	6	164	250	68.2	84.6	58.5	51.6	70.6	63.2	0.143
Do you suffer from breathlessness when you laugh?	5	6	409	44.1	50.0	42.9	44.7	53.6	45.5	0.636
Does your chest trouble make you feel impatient?	3	2	415	69.8	75.0	67.5	61.0	82.9	70.4	0.097
Do you think the fullness of your life is limited by your chest trouble?	3	2	415	88.1	68.8	80.0	73.2	92.8	83.3	0.01
Do you feel drained after a cold because of your chest trouble?	3	28	389	88.5	93.3	82.1	89.2	86.8	85.9	0.465
Do you have a feeling of chest heaviness?	4	3	413	65.0	81.3	56.6	54.8	71.0	62.2	0.08
Do you worry a lot about your chest trouble?	6	3	411	60.8	46.7	58.1	62.5	67.6	60.5	0.528