National audit of acute severe asthma in adults admitted to hospital

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Abstract

Objective—To ascertain the standard of care for hospital management of acute severe asthma in adults.

Design—Questionnaire based retrospective multicentre survey of case records.

Setting—36 hospitals (12 teaching and 24 district general hospitals) across England, Wales, and Scotland.

Patients—All patients admitted with acute severe asthma between 1 August and 30 September 1990 immediately before publication of national guidelines for asthma management.

Main measures—Main recommendations of guidelines for hospital management of acute severe asthma as performed by respiratory and non-respiratory physicians.

Results—766 patients (median age 41 (range 16–94) years) were studied; 465(63%) were female and 448(61%) had had previous admissions for asthma. Deficiencies were evident for each aspect of care studied, and respiratory physicians performed better than non-respiratory physicians. 429(56%) patients had had their treatment increased in the two weeks preceding the admission but only 237(31%) were prescribed oral steroids. Initially 661/766(86%) patients had peak expiratory flow measured and recorded but only 534(70%) ever had arterial blood gas tensions assessed. 65(8%) patients received no steroid treatment in the first 24 hours after admission. Variability of peak expiratory flow was measured before discharge in 597/759(78%) patients, of whom 334(56%) achieved good control (variability <25%). 47(6%) patients were discharged without oral or inhaled steroids; 182/743(24%) had no planned outpatient follow up and 114 failed to attend, leaving 447(60%) seen in clinic within two months. Only 57/629(8%) patients were recorded as having a written management plan.

Conclusions—The hospital management of a significant minority of patients deviates from recommended national standards and some deviations are potentially serious. Overall, respiratory physicians provide significantly better care than non-respiratory physicians.

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Keywords: national audit, acute severe asthma, guidelines, change in clinical practice.

Introduction

The prevalence of asthma is increasing, and asthma now affects two million adults (5% of the population) and one million children (10% of the population) in the United Kingdom. Between 1975 and 1985 recorded deaths from asthma doubled to over 2000 deaths a year.¹ Studies of the circumstances of deaths from asthma have consistently shown potentially preventable factors in over 80%,^{2–5} the commonest problems being failure to appreciate the nature or severity of the asthma (usually because of a failure to make measurements) and failure to prescribe systemic steroids.

In 1990, after an initiative from the British Thoracic Society, guidelines for the management of acute severe asthma produced jointly by a group of respiratory physicians, general physicians, and general practitioners and endorsed by a national meeting of the British Thoracic Society were published.⁶ These guidelines represent what was agreed by a group of practitioners interested in asthma care to be the most appropriate management of acute asthma. The aim was to disseminate widely through the guidelines information on good management of asthma.

The paper reports a multicentre survey, organised by the British Thoracic Society's standards of care committee, which set out to determine the care received by adults admitted to hospital with acute asthma in the months before publication of the guidelines and to compare current practice with the recommendations of the guidelines. It focuses on a few important aspects of hospital management of acute asthma and relates these to the relevant recommendations of the guidelines (box).

Methods

The survey was a questionnaire based retrospective audit of case records of patients admitted as emergencies with acute severe asthma in August and September 1990 immediately before publication of the guidelines.

HOSPITALS

Forty physicians, all interested in asthma care, were invited to be the survey coordinator for their hospital. Criteria for invitation included geographical spread across England, Wales, and Scotland and a suitable mix of teaching and non-teaching hospitals.

CASE DEFINITION

All adult patients admitted to the participating hospitals as emergencies with acute severe asthma between 1 August and 30 September

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Summary of recommendations of asthma guidelines⁶ for adults with acute severe asthma relevant to study

Clinical assessments

Assessment of level of consciousness:

- Recording of: ability to speak in complete sentences
- heart rate
- respiratory rate
- pulsus paradoxus

Measurement of: peak expiratory flow
arterial blood gas tensions

Treatment on arrival should include:

High dose nebulised β_2 agonist – if patient not improving at 15–30 minutes repeat dose or add nebulised ipratropium bromide
High dose systemic steroids
If obviously life threatening features present add intravenous aminophylline

Management in hospital

Patients should not be discharged until symptoms have settled and lung function has stabilised – that is, peak expiratory flow > 75% predicted (or best) and diurnal variability <25%

Discharge from hospital

All patients should be discharged taking oral steroids for 1–3 weeks and inhaled anti-inflammatory treatment (steroids)
All patients should have a written self management plan
All patients should have outpatient follow up

1990 were included in the survey. The diagnosis of asthma was taken as that made by local physicians. Patients admitted electively for investigation or stabilisation of asthma were excluded. The method of identification of cases was determined by the local coordinators, who were responsible for verifying the diagnosis, for ensuring that all patients admitted with acute severe asthma to their hospital were included in the survey, and for obtaining the agreement of their physician colleagues. The methods of identifying cases varied between centres and included specific asthma registers, hospital activity analyses from hospital computer databases, and admission registers in the accident and emergency departments.

QUESTIONNAIRE

A questionnaire, derived from the criteria set out in the guidelines, was designed to assess those features of care considered to be the most crucial aspects of management of acute asthma. These included acute assessment of the patient and initial treatment, monitoring progress in hospital, the discharge process, and arrangements for follow up within the subsequent two months. The questionnaire was piloted in five hospitals and modified to ensure that the questions were unambiguous and answerable from the data likely to be available

in the case notes. (The full questionnaire is available on request from the authors.)

The local study coordinators obtained the case notes and completed the questionnaire for each patient with acute severe asthma.

DATA ASSESSMENT AND ANALYSIS

Completed questionnaires were collected centrally and the responses entered on to a computer with Microstat software (Ecosoft, Indiana). When necessary, the data were verified with the individual unit to check its accuracy. Statistical comparisons were made with χ^2 test to compare incidences of events and by non-parametric analysis of variance (Kruskal-Wallis test).

Results

Thirty six physicians, representing 12 teaching hospitals and 24 district hospitals, accepted the invitation to take part.

Seven hundred and sixty six adult patients with acute severe asthma were admitted to the 36 hospitals in the two month survey period; a median of 21 (range 7–57) patients were admitted per hospital. Median age was 41 (range 16–94) and 465/742(63%) were female. Nearly half (372, 49%) were referred directly by a general practitioner, 348(45%) arrived by emergency ambulance, 30(4%) self presented, and for 16 the mode of arrival was not recorded. A total of 61%(448/734) of these admissions were readmissions, 14%(100/734) within eight weeks after discharge from a previous episode of asthma. Four hundred and twenty six (56%) patients were admitted by a physician with an interest in respiratory medicine, 306(40%) by general physicians, and 34(4%) by geriatricians.

TREATMENT BEFORE ADMISSION

Table 1 shows the patients' characteristics and their treatment before admission. At the time of admission a total of 488 patients (63%) were already taking inhaled steroids and 172(22%) oral steroids, who included significantly more patients cared for by respiratory physicians than by other physicians (inhaled steroids 297/426, 70% v 191/340, 56%; oral steroids 122/426, 29% v 50/340, 15%; $p < 0.001$), suggesting that more severe cases were being routed to specialist physicians. Of a total of 448 patients who had had a previous admission for asthma, 132(29%) were not receiving any form of prophylactic treatment.

Four hundred and twenty nine (56%) patients had had their treatment for asthma increased or supplemented in the two weeks

Table 1 Characteristics and previous regular treatment of patients with acute severe asthma, by physician in charge of care

	General physician or geriatrician (n = 340)*	Respiratory physician (n = 426)*	Total (n = 766)*	Significance
Median (range) age (years)	41(16–94)	41(16–91)	41(16–94)	
No (%) women	212/327(65)	253/415(61)	465/742(63)	
No (%) current smokers	108/295(37)	105/412(25)	213/707(30)	
No (%) receiving oral steroids	50/340(15)	122/426(29)	172/766(22)	$\chi^2 = 20.2$, $p < 0.001$
No (%) receiving inhaled steroids	191/340(56)	297/426(70)	488/766(64)	$\chi^2 = 14.9$, $p < 0.001$
No (%) with previous admissions	166/322(52)	282/412(68)	448/734(61)	$\chi^2 = 20.9$, $p < 0.001$
No (range) days in hospital	4(1–34)	5(1–41)	5(1–41)	

*Denominators may vary owing to unavailability of data for some variables.

Table 2 Differences in hospital care of adult patients with acute severe asthma between non-respiratory and respiratory physicians. Figures are numbers (percentages)

	General physicians (n = 340)*	Respiratory physicians (n = 426)*	χ^2	Significance
<i>At admission and during inpatient stay</i>				
Measurement of peak expiratory flow on admission	282/340(83)	379/426(89)	5.3	p < 0.05
Measurement of arterial blood gas tensions on admission	197/340(58)	337/426(79)	39.1	p < 0.001
No steroid treatment in first 24 hours	41/340(12)	24/426(6)	8.5	p < 0.01
Within day variability of peak expiratory flow not measured in ward	92/336(27)	70/423(17)	12.5	p < 0.001
<i>On discharge and at follow up</i>				
Home management plan not given	266/282(94)	306/347(87)	7.6	p < 0.005
No steroids at all given on discharge	31/336(11)	16/422(4)	3.98	p < 0.05
No outpatient appointment made	146/335(44)	36/408(9)	124.0	p < 0.001
Seen in outpatient department within two months of discharge	149/335(44)	298/408(73)	61.4	p < 0.001

*Denominators may vary owing to unavailability of data for some variables.

before admission. Additional treatment included oral steroids (237, 31%), nebulised bronchodilators (178, 23%), and antibiotics (138, 18%), either given alone or in combination. Moreover, for 70(39%) of those given nebulised β agonists and 66(48%) of those prescribed antibiotics, oral steroids were either not prescribed or not increased. Sixty one patients (8%) had increased the dose of inhaled steroids, in most cases with the introduction of an additional drug.

ASSESSMENT ON ADMISSION

On admission 13(2%) patients were unconscious, 32(4%) were confused, and a further 152 (20%) were too breathless to speak in sentences. In all, 58/677 were noted as clinically cyanosed. Heart rate was recorded in 759/766(99%) patients, of whom 253(33%) had a significant tachycardia (≥ 110 beats/min). Respiratory rate (444 patients, 58%) and pulsus paradoxus (314 patients, 41%) were recorded less frequently.

Measurement and analysis of peak expiratory flow rate

Peak expiratory flow was measured in 661(86%) patients on arrival at hospital (table 2), its median value being 170 l/minute (range unrecordable to 470 l/min). Of the 484/611(73%) patients with a peak expiratory flow of 200 l/minute or less, 434(90%) also had their peak expiratory flow measured before discharge. All but 35(8%) showed an improvement in peak expiratory flow of 50% or more during the admission. Only 11 patients had a peak expiratory flow on admission of more than 400 l/minute.

Measurement and analysis of arterial blood gas tensions

Arterial blood gas tensions were measured in 191(25%) patients in the accident and emergency department and in a further 343(45%) on reaching the ward. The concentration of inspired oxygen ($F_{I}O_2$) was recorded for 378/534(71%) of the blood gas analyses.

Respiratory physicians were significantly more likely to measure arterial blood gas tensions in patients admitted under their care (table 2). The use of blood gas measurements varied hugely between hospitals, ranging from 0% to 75% of patients in accident and emergency departments whereas in the wards one hospital never performed blood gas measurements and another always did.

In 181 patients with a very low initial peak expiratory flow (<100 l/min), and thus judged to have very severe asthma, 149(78%) had arterial blood gas tensions recorded, of whom 37(25%) had a P_{CO_2} above 6 kPa, signifying a dangerous situation for the patient. In comparison, 33(15%) of 226 patients whose peak expiratory flow was between 101–200 l/minute and seven (6%) of 106 patients with a peak expiratory flow more than 200 l/minute had a raised P_{CO_2} . (12/52 patients who had their arterial blood gas tensions recorded but no measurement of peak expiratory flow had a high P_{CO_2} .)

Chest radiography

Seven hundred and forty seven patients (98%) had a chest x ray on admission, in eight (1%) of whom pneumothoraces were detected.

TREATMENT ON ADMISSION

Bronchodilators

As shown in table 3 most patients (699, 91%) received nebulised bronchodilators on arrival, which was combined with a nebulised anticholinergic drug in 481(63%). Those who did not receive a nebulised β agonist were younger than those who did (median age 34 v 45 years), were more likely to have had previous admissions (503/699, 72% v 40/67, 60%; $\chi^2 = 3.9$, p < 0.05), included several taking regular oral steroids (45/77(58%) v 126/699(18%), p < 0.001), and had slightly higher median peak expiratory flow (205 l/min v 160 l/min; p < 0.05). Non-nebulised inhaled β agonists were given to 51 patients, intravenous β

Table 3 Initial treatment given on arrival at hospital by type of physician in charge of care. Figures are numbers (percentages)

	General physician (n = 340)	Respiratory physician (n = 426)	Total (n = 766)
<i>Bronchodilators</i>			
Nebulised or intravenous β agonist	307/340(90)	392/426(92)	699/766(91)
Nebulised anticholinergic drug	201/340(59)	280/426(66)	481/766(63)
Intravenous theophylline	41/318*(13)	37/372*(10)	78/690*(11)
<i>Steroids</i>			
Systemic steroids	272/340(80)	374/426(88)	646/766(84)
Inhaled steroids alone	27/340(8)	28/426(7)	55/766(7)
No steroids in first 24 h	41/340(12)	24/426(6)**	65/766(8)

*Denominators for theophylline are low owing to missing data.

** $\chi^2 = 11.1$, df = 2; p < 0.01, for pattern of steroid use between respiratory and general physicians.

agonists to five patients, nebulised anticholinergic drugs alone to 12, and intravenous aminophylline to nine.

Steroids

In all, 646 (84%) patients received either oral or intravenous steroids either on admission or within the first 24 hours (table 3). A further 55(7%) were prescribed inhaled steroids alone, but 65(8%) had no recorded steroid treatment at all in the first 24 hours. Those not prescribed any steroids were similar in age and sex and had as severe asthma as those who were (15/65, 23% unable to speak in sentences *v* 182/701, 26%; median peak expiratory flow 190 *v* 160 l/min) but were significantly more likely to be under the care of a non-specialist physician (40/65, 62% *v* 300/701, 43%; $\chi^2 = 7.7$, $p < 0.01$). One death occurred in these 65 patients. Most (70%) were discharged with inhaled or oral steroids, or both.

Monitoring asthma during inpatient stay

Peak expiratory flow was recorded regularly during inpatient stay for 644/766(84%) patients. Measurement of the within day variability of the peak expiratory flow is an indicator of asthma control. In 47 patients the peak expiratory flow was recorded only once daily, thus adequate measurements for calculating variability of peak expiratory flow were available in 597/759(79%) patients (353/423, 83% for respiratory physicians, 244/336, 72% for general physicians; $\chi^2 = 12.4$, $p < 0.01$). Patients without adequate peak expiratory flow records had similarly severe asthma in terms of the heart rate at admission, peak expiratory flow, P_{CO_2} , and admissions to the intensive care unit. They were significantly more likely to be sent home without oral or inhaled steroids than those with adequate records (23/162, 15% *v* 24/596, 4%; $\chi^2 = 23.2$, $p < 0.001$) and to have no planned clinic follow up (45/162, 28% *v* 116/581, 20%; $\chi^2 = 4.5$, $p < 0.05$).

Of the 597(79%) patients whose variability of peak expiratory flow before discharge could be calculated, 334(56%) achieved good control of peak expiratory flow (defined as less than 25% variability whereas 70(12%) had a greater than 45% variability. The variability of peak expiratory flow was independent of age, the type of physician, and the size of the highest peak flow before discharge. A high (>25%) variability was a predictor of early readmission within two months (42/252, 17% *v* 33/332, 10% readmitted; $\chi^2 = 5.2$, $p < 0.05$).

Table 4 Comparison of treatment and follow up between patients discharged with or without steroids

	Without steroids (n = 47)	With oral or inhaled steroids, or both (n = 711)
Median (range) age (years)	41(17–86)	40(16–94)
Median peak expiratory flow on admission (l/min)	190(0–350)	165(0–460)
Best median (range) peak expiratory flow (l/min)	370(110–590)	365(100–690)
No (%) with variability of peak expiratory flow measured	25/47(51)	552/711(79)*
No (%) with planned outpatients appointment	19/47(37)	563/686(81)
No (%) under care of general physicians	31/47(65)	304/711(42)*

* $p < 0.01$.

LENGTH OF STAY

Median length of stay was five (range 1–41) days. Patients under the care of general physicians had a shorter median stay (four (1–41) days with 95/340 (28%) discharged home within 48 hours compared with patients under the care of respiratory physicians (five (1–37) days)). However, this difference disappeared if patients receiving oral steroids regularly before the admission are excluded. The 172 patients taking steroids regularly stayed in hospital for a median of seven days (range 1–37) and 129(75%) of them were under the care of respiratory physicians.

Self discharge

In total, 37(5%) patients discharged themselves: they were younger (28 were under 35 years), went home earlier (75% inside two days) and were more likely to be under the care of a non-specialist physician (23/336, 7% *v* 14/423, 3%; $\chi^2 = 4.3$, $p < 0.05$). They represent 15% of the early discharges within two days.

TREATMENT ON DISCHARGE

On discharge only 491/758(65%) were prescribed both oral and inhaled steroids, and 47 patients (6%) were prescribed neither (table 2). These 47 patients had similar peak expiratory flow on admission, best peak expiratory flow before discharge and variability of peak expiratory flow (when measured) to the others. They were less likely to have a planned follow up, and again significantly more were under the care of non-specialist physicians (table 4).

Only 57/629(8%) patients were recorded as having been given a written management plan (table 2).

FOLLOW UP

A total of 182(24%) of 743 patients for whom data were available had no planned outpatient appointment (table 2). Patients under the care of respiratory physicians were more likely to have outpatient follow up than those cared for by other physicians (372/408, 91% *v* 189/335, 56%; $\chi^2 = 118.3$, $p < 0.001$). This was not related to peak expiratory flow or other markers of severity; in all, 447/743(60%) patients were known to have attended their follow up appointment.

Patients aged under 45 years were twice as likely to fail to attend the clinic than older patients (76/285, 27% *v* 33/246, 15% *v* 45; $\chi^2 = 13.4$, $p < 0.001$). Thus of those aged under 45 only 73/182(40%) cared for by a general physicians and 136/215(63%) of those cared for by respiratory physicians were seen in clinic.

Only 10 of the 37 patients who discharged themselves were later reviewed in clinic.

Readmission

One hundred and two patients (13%) were readmitted to the same hospital within two months of this index admission. They were of similar age and sex and had similar initial peak expiratory flow to those 649 not readmitted,

but they were significantly more likely to have had previous admissions (time unstated) (93/102, 91% *v* 363/649, 56%; $\chi^2 = 44.4$, $p < 0.001$); to be receiving regular oral steroid treatment (45/102, 44% *v* 126/649, 19%; $\chi^2 = 29.2$, $p < 0.001$); to have regular nebulised β agonist treatment at home (38/102, 37%, *v* 71/646, 11%; $\chi^2 = 46.7$, $p < 0.001$); and to have been discharged with a variability in peak expiratory flow greater than 25% (42/75, 56% *v* 210/509, 41%; $\chi^2 = 5.3$, $p < 0.02$).

DEATHS

Nine deaths occurred, of which two occurred in the two months after discharge. The patients who died were older (median age 68 years, range 40–94 years) and had lower peak expiratory flow on admission (median 85 l/min, range unrecordable to 175 l/min). No hospital related factors could be identified to explain the deaths.

Discussion

This study describes some aspects of the process of care for 766 adult patients admitted to hospital with acute severe asthma in 1990, immediately before publication of the asthma guidelines.⁶ Many areas of apparent deficiencies in care, as judged against the recommendations in the guidelines, were demonstrated.

As the guidelines represent a framework for decision making and may not account for unusual or difficult cases some variation from them may be expected. However, the magnitude of the differences observed in this survey greatly exceeds the likely number of unusual cases. However, methodological issues need to be considered.

The diagnosis of asthma was verified by the local study coordinators who all had an interest in asthma care and had been instructed to include only cases of acute severe asthma. The doubling of median peak expiratory flow between admission and discharge strongly suggests that the diagnosis was correct in most instances. Of course a few cases may represent an overlap of asthma with chronic obstructive pulmonary disease, but since the treating physicians had considered each patient to have asthma their management can reasonably be compared with that in the guidelines.

Inclusion of a hospital in the study depended largely on the presence of a willing study coordinator interested in asthma care and thus the sample may not be representative of care throughout the United Kingdom and probably represents a bias towards better quality care and thus underestimates the problems that exist. Teaching hospitals were overrepresented in the sample.

This survey was dependent on information recorded in case notes. The problems of the completeness of medical notes have been described before.⁷ Although some of the information – for example, that obtained from drug prescription sheets – is likely to be complete, some of the observed deficiencies will reflect omissions in recording. But, for example, measuring peak expiratory flow

without recording the results both limits the usefulness of that test, as without a record it cannot be used for later comparison, and raises doubts about whether the information was taken seriously and acted on.

The observed deficiencies in recorded care suggest that many patients with acute asthma receive some care that falls outside the recommendations in the guidelines. Systemic steroids have been accepted as central to managing acute severe asthma for over 25 years.⁸ Many studies have highlighted failure to use systemic steroids as a factor in “avoidable” asthma deaths,^{2–5 9–15} and yet 15% of patients in this survey did not receive systemic steroids within 24 hours of admission. It is such deficiencies of care, which may have a significant influence on outcome, that the authors of the guidelines sought to eliminate.

More than one patient in seven in this survey did not have peak expiratory flow rate recorded on admission. Peak flow meters are a cheap, direct, and widely available clinical measurement of airway narrowing – the main physiological abnormality of asthma. Peak expiratory flow rate is a marker of severity of asthma and also the simplest test by which to assess response to treatment. Failure to measure and record peak expiratory flow may reflect a lack of awareness of asthma. The within day variability of peak expiratory flow rates relates to asthma symptoms and to airway “twitchiness”¹⁶ or stability of asthma and can be used to indicate when discharge from hospital is appropriate. Without measuring peak expiratory flow it is difficult to assess recovery fully. But in this survey nearly a quarter of patients did not have variability of peak expiratory flow measured. Neither failure to measure this variability nor failure to give systemic steroids was related to asthma severity. Thus patients with very severe asthma, who have most to gain from both administration of systemic steroids and confirmation of acceptable within day variability before discharge, may have been put at unacceptable risk.

Simple measures of outcome are not easy to define or measure. Although much of the concern about the quality of asthma care has been prompted by the number of avoidable deaths from asthma, death in hospital from asthma is uncommon, and most asthma deaths occur outside hospital.^{2 4 5 17 18} Assessing the quality of asthma care rests largely on measures of the process of care and it was beyond the scope of this survey to examine outcome. Nevertheless, early readmissions were found to be frequent; more than one patient in eight was subsequently readmitted within two months of this index admission. These patients seem to have had worse asthma preceding this admission in terms of their previous admissions and the amount of regular pharmacotherapy. However, their asthma, in terms of variability of peak expiratory flow, was less well controlled on discharge than those not readmitted. Postponing discharge until the variability had lessened may have obviated the need for readmission, but it is beyond the power of this

retrospective survey to detect deficiencies in care that may have caused early relapse.

Differences were highlighted between the care given by respiratory physicians and other physicians. Studies from several centres have shown that both the process and outcome of asthma care are significantly better when the teams looking after patients include a respiratory physician.¹⁹⁻²² Such differences should not be surprising; asthma care is central to the work of respiratory physicians who are cognisant of the dangers of acute asthma and familiar with its management and look after many more patients with asthma, including those with most severe asthma, than their colleagues. This survey provides further evidence to demonstrate that there is an advantage in terms of the process of care for those patients looked after by respiratory physicians. Nevertheless, the differences are not absolute and many general physicians continue to provide excellent care. The difference between specialist and non-specialist has been well described elsewhere too. Perhaps the best documented example is the Confidential Enquiry into Perioperative Deaths (CEPOD) which showed that surgeons performing particular procedures frequently achieved lower mortality rates than surgeons performing the same procedure occasionally.²³

In our survey the most noticeable difference concerned follow up arrangements. Respiratory physicians were more likely to arrange outpatient follow up for their patients than other physicians. This seemed to be a particular issue in younger patients (those aged below 45). Pressures of work or family commitments may explain difficulties in getting to clinics in this age group. Some will be looked after in primary care. Whether either short term or long term outcome of those who do not attend follow up differs from those who do is not known. The guidelines recommend follow up after discharge. This seems a correct policy. Adjustments may need to be made to drugs, and for some patients important decisions about oral steroids will be made in the outpatient clinic. More work is needed to define the outcome for this group and establish whether this group who should be targeted for specific attention or left alone.

As most care is actually given by junior staff, differences in the process of care between respiratory physicians and other physicians may reflect policies for, and training of, junior staff. For example, no difference was observed between the frequency of arterial blood gas measurements done in the accident and emergency department, where the major influence is likely to be from the department's staff, between patients admitted by respiratory and other physicians; but patients looked after by respiratory physicians were more likely than the rest to have arterial blood gas tensions measured in the ward. Not surprisingly, the respiratory physicians' practice is closer to the recommendations in the guidelines.

Some of the clinical practice observed that was outside the guidelines may nevertheless be medically correct. Guidelines cannot allow for

factors pertinent to every individual, such as comorbidities, pregnancy, allergies, or sensitivities. In some cases the variations in practice may be where clinical studies have yet to define the relative advantages of one approach of care versus another. For example, nearly two thirds of patients received both β agonist and anticholinergic drug by nebuliser as first line treatment. The 1990 guidelines recommended nebulised β agonist alone with addition of the anticholinergic agent only if clinical response did not occur.⁶ But this is an area where more clinical studies are required, firstly, to tell us whether the different approaches affect outcome^{24 25} and, secondly, to define for what proportion of patients the guidelines are medically applicable and appropriate.

The obstacles to good care of people with acute severe asthma go beyond the problems of the process of care of those admitted to hospital. In this survey almost a third of those admitted who had had previous admissions to hospital were not taking any form of prophylaxis. Whether this is the failure of the doctor to prescribe, or the patient to collect, inhaled steroids cannot be determined from this study. Moreover, more than half those patients admitted had clearly sought medical advice in the two weeks before admission but had not been given the extra steroids that might have prevented the admission. Potential opportunities for prescribing anti-inflammatory treatment to prevent exacerbations or to treat adequately the early symptoms of worsening asthma may have been missed.

This large national survey of hospital care of patients with acute severe asthma suggests that there is room for improvement and that publication of the guidelines was timely. Whether the guidelines, published in *BMJ*²⁴ as well as in the specialist journal *Thorax*²⁵ to ensure maximum coverage, will provide the guidance needed to improve asthma care remains to be seen. Better care may reduce the 12% early readmission rate and reduce the morbidity of asthma. Patients have a right to expect a high quality of care. Most of the deficiencies outlined here could be corrected by better understanding of asthma and better application of well established treatment practices.

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- 1 Lung and Asthma Information Agency. Trends in asthma mortality in the elderly. London: Department of Public Health, St Georges Hospital Medical School, 1992. (Factsheet 92/1.)
- 2 British Thoracic Association. Death from asthma in two regions of England. *BMJ* 1982;285:1251-5.
- 3 Sears MR, Rea HH, Beaglehole RG, Gillies AJ, Holst PE, O'Donnell TV, et al. Asthma mortality in New Zealand: a two year national study. *NZ Med J* 1985;98:271-5.

- 4 Eason J, Markowe HLJ. Controlled investigation of deaths from asthma in the North East Thames region. *BMJ* 1987;**294**:1255-8.
- 5 Wareham NJ, Harrison BDW, Jenkins PF, Nicholls J, Stableforth DE. A district confidential enquiry into deaths due to asthma. *Thorax* 1993;**49**:1117-20.
- 6 Guidelines for the management of asthma in adults. 2. Acute severe asthma. Statement by the British Thoracic Society, Research Unit of the Royal College of Physicians of London, King's Fund Centre, National Asthma Campaign. *BMJ* 1990;**301**:797-800.
- 7 Gabbay J, Layton A. Evaluation of audit of medical inpatient records in a district general hospital. *Quality in Health Care* 1992;**1**:43-7.
- 8 Report to the Medical Research Council by the sub-committee on clinical trials in asthma. Controlled trial of effects of cortisone acetate in status asthmaticus. *Lancet* 1956;**ii**:803.
- 9 Speizer FE, Doll R, Heaf P. Observations on recent increases in mortality from asthma. *BMJ* 1968;**i**:335.
- 10 Speizer FE, Doll R, Heaf P, Strang LB. Investigation into use of drugs preceding death from asthma. *BMJ* 1968;**i**:339.
- 11 Cochrane GM, Clark TJH. A survey of asthma mortality in patients between ages 35 and 64 in the Greater London hospitals. *Thorax* 1975;**30**:300-5.
- 12 MacDonald JB, Seaton A, Williams DA. Asthma deaths in Cardiff 1967-74: 90 deaths outside hospital. *BMJ* 1976;**i**:1495-6.
- 13 MacDonald JB, MacDonald ET, Seaton A, Williams DA. Asthma deaths in Cardiff 1967-74: 53 deaths in hospital. *BMJ* 1976;**i**:721-2.
- 14 Bateman JRM, Clarke SW. Sudden death in asthma. *Thorax* 1979;**34**:40-4.
- 15 Ormerod LP, Stableforth DE. Asthma mortality in Birmingham 1974-7: 53 deaths. *BMJ* 1980;**280**:687-90.
- 16 Udwardia ZF, Harrison BDW. An attempt to determine the optional duration of hospital stay following a severe attack of asthma. *J Coll Physicians (Lond)* 1990;**24**:112.
- 17 Rea HH, Scragg R, Jackson R, Beaglehole R, Fenwick J, Sutherland DC. A case control study of deaths from asthma. *Thorax* 1986;**41**:833-9.
- 18 Pearson MG, Sloan R, Ryland I. Asthma in general practice - prevalence and treatment. *Thorax* 1992;**47**:846P.
- 19 Osman J, Ormerod LP, Stableforth DE. Management of acute asthma: a survey of hospital practice and comparison between thoracic and general physicians in Birmingham and Manchester. *Br J Dis Chest* 1987;**81**:232-41.
- 20 Baldwin DR, Ormerod LP, Mackay AD, Stableforth DE. Changes in hospital management of acute severe asthma by general and thoracic physicians in Birmingham and Manchester during 1978 and 1985. *Thorax* 1990;**45**:130-5.
- 21 Bucknall CE, Robertson C, Moran F, Stevenson RD. Differences in hospital asthma management. *Lancet* 1988;**i**:748-50.
- 22 Bell D, Layton AJ, Gabbay J. Use of a guideline based questionnaire to audit hospital care of acute asthma. *BMJ* 1991;**302**:1440-3.
- 23 Confidential enquiry into perioperative deaths (CEPOD). London: HMSO, 1991.
- 24 Guidelines on the management of asthma. *BMJ* 1993;**306**:776-82.
- 25 Guidelines on the management of asthma. *Thorax* 1993;**48**:S1-24.