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# A national audit of the secondary care of “acute” asthma in Wales – February 2006

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## Summary

**Background:** No national audit of acute asthma in secondary care has been undertaken since 1991 in spite of further revisions of national guidelines. There has been no audit of the patient course through the ambulance, accident and emergency units (A&E), medical admission units (MEAU) and in-patient care in an integrated manner.

**Aim:** To audit the care of acute asthma in the various areas of secondary care in all hospitals in Wales in February 2006.

**Methods:** Standardised audit forms were produced to assess ambulance performance during transfer, A&E and MEAU care and in-patient care where admission occurred. The results were compared to national guidelines.

**Results:** Acute asthma in Wales is a common reason for hospital attendance, 30% of such patients appear to be mild but 19% are severe/acute severe. British Thoracic Society (BTS)/Sign assessment of severity is rarely performed and both monitoring of progress and the discharge process are disappointing. There are major incompatibilities between BTS/Sign guidelines and the current Welsh Ambulance Service protocol. A similar problem exists with the British Society of Accident and Emergency Medicine (BAEM) protocol for moderate asthma.

**Conclusions:** This audit demonstrates disappointing adherence to BTS/Sign guidelines for the care of acute asthma. A new approach to acute asthma care in Wales is required.

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## Introduction

The publication of national guidelines on the management of acute asthma 20 years ago promised to standardise management in this common cause of emergency admission

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to secondary care.<sup>1</sup> Subsequent audits showed that some progress had been made but there was still considerable scope for improvement.<sup>2</sup> There has been no further national audit of acute asthma care and those published elsewhere have emphasised either care in A&E units or whilst in-patients on MEAU, in spite of further revisions of UK guidelines.<sup>3–6</sup> There has been only limited audit of transfer by ambulance and subsequent secondary care.

Further, since the last national audit in the UK there have been major structural changes to emergency care of such patients. There has been an extension of the role of the para-medical practitioners in the ambulance service,<sup>7</sup> the creation of MEAUs (units designed to manage acute medical emergencies unrelated to trauma), the expansion of the role of asthma specialist nurses and various forms of physician-led in-patient care. Although some individual aspects have been audited, there has been no audit of the overall changes and their effects on emergency care of asthma.<sup>8</sup> In addition, Asthma UK (Cymru) was critical of the care of patients in Wales,<sup>9</sup> particularly the higher death and admission rates. Initial enquiries had revealed widespread variation in the protocols at each district general hospital (DGH) for the management of acute asthma. We therefore felt that a national audit of acute asthma care should be performed with the data collection being carried out by middle grade doctors and the analysis performed centrally against agreed standards.

## Methods

Proformas were developed in association with the Pre-Hospital Emergency Research Unit (PERU) in Cardiff to assess care during transfer to hospital by ambulance, with consultants in A&E medicine and consultant physicians specialising in chest medicine. The proformas were based on the BTS/Sign audit recommendations with additional questions developed locally (see Appendix A). Specialist registrars (SpR) in thoracic medicine attended a workshop to examine the proformas and address concerns relating to individual hospitals. Proformas were trialled by one of the authors (RHM) at one centre and no modifications were needed. The audit covered all DGH in Wales. Data was analysed and recorded as above except in five hospitals where data was extracted and recovered by two of the authors (BHD/PES) with the partial assistance of medical staff in one centre.

The data sets were analysed by one of the authors (KM) using Minitab<sup>®</sup> release version 14, (Havertown Pa). Associations between groups were tested using  $\chi^2$  analysis and Spearman's ranked correlation method. Two-sample comparisons were performed using the two-sample *t*-test for data assumed to be normally distributed, and the Mann–Whitney test for non-normally distributed data. Results were deemed significant when  $p < 0.05$  throughout.

## Audit results

The data is divided into three groups: care in the ambulance, care in A&E departments or MEAU and in-patient care for all patients with a duration of stay of 24 h or more. Of the 248 patients admitted, 197 attended via A&E, 49 via

**Table 1** Patient demographics.

	<i>n</i>	M/F
<i>Sex</i>		
Male	79	
Female	165	
Not documented	4	
<i>Age distribution</i>		
18–30 years	72	21/48 <sup>a</sup>
31–50 years	67	17/49 <sup>b</sup>
51–70 years	73	31/42
71+ years	36	10/26

<sup>a</sup> Three not documented.

<sup>b</sup> One not documented.

MEAU. The route of admission of two patients was not documented.

## Overall national pattern

The 17 DGH/teaching hospitals in Wales all contributed to the study. The individual totals of patients admitted and classification of severity for each hospital are included in Appendix B. Overall 284 patients were admitted in February 2006 and data was obtained in all cases, (36 cases were excluded as there was no evidence of asthma as the admitting diagnosis either on PEFr recording or subsequent clinical course). The demographics and mode of admission are shown in Table 1. The severity groupings are shown in Table 2 but it should be emphasised that severity was rarely coded in the admitting documentation and in 15% no classification of severity was possible by the SpR. However, in this group, 7/38 were assessed as having acute severe/severe asthma on the basis of either a measured peak expiratory flow rate (PEFR), pulse rate, respiratory rate and subsequent clinical progress. One patient died of causes unrelated to asthma. The ratio of acute severe/severe asthma to overall admissions was 18%, three hospitals coded over 30% of cases as ac. severe/severe and in one of these hospitals 50% were in this group.

## Ambulance care

Ninety-seven out of the total of 248 cases called an ambulance, six cases had further transfers to other hospitals. Individual patient clinical record (PCR)/incident numbers were available in 63/65 cases respectively. Table 3 shows the age distribution and source of the initiating call. Clinical data was recorded in 72 cases of which 68 had

**Table 2** Severity coding – 248 patients.

	Acute severe	Severe	Moderate	Mild	Not documented
<i>n</i>	14	30	91	75	38
%	5.6	12	37	30	15.4

In 38 cases where severity was not documented, 7 (18%) would be classified as acute severe/severe asthma. Formal severity coding was rarely performed by the admitting staff in A&E/MEAU.

**Table 3** Ambulance care – demographics, call sources and clinical assessment.

	<i>n</i> (%)
<i>Age distribution</i>	
18–30 years	18/72 (25)
31–50 years	20/67 (30)
51–70 years	36/73 (49)
71+ years	23/36 (64)
<i>Call source</i>	
Direct calls	63
Dr called	3
Others	6
Clinical assessment ( <i>n</i> =72 cases)	
Respiratory rate	66/72
Pulse	71/72
O <sub>2</sub> saturation	64/72
PEFR	8/72

respiratory rate, 72 pulse rate and 64 had oxygen saturations (range 73–100%) measured. Only eight cases had peak flow recorded. Treatment given in the ambulance is outlined in Table 4, the vast majority of patients having high flow oxygen and nebulised salbutamol. Only five cases received steroids (all hydrocortisone). Secondary therapy was rarely used, only one case receiving adrenaline. Only a minority of cases had any repeat observations during the transfer to hospital.

Using the A&E/MEAU initial severity coding, Table 5 shows that there was no relationship between ambulance usage and severity with a significant number of cases requiring no in-patient care. There was a wide disparity in out of hours requests (17:00–09:00) for ambulance transfer in the various centres in Wales ranging from 16 to 83% with an average of 54%. There appeared to be no relationship to population size, availability of out of hours care or severity of asthma at presentation at A&E/MEAU. There also appeared to be no relationship between the therapy administered by ambulance crews and subsequent therapy in A&E/MEAU, 59 of 72 patients were again immediately

**Table 4** Ambulance care – therapy and outcomes.

Therapy	<i>n</i>	Outcome
Oxygen – 49/72	38	100%
	11	24/60%
	14	Not documented
	9	None/refused
Nebulised salbutamol	55/72	38 × 1; 15 × 2; 2 × 3 doses
Steroids	5/72	Hydrocortisone
Repeat observations	27/72	Outcome: 23/97 admitted of which 15 stayed <24 h

Significant positive correlation between high flow O<sub>2</sub> and A&E admission ( $p < 0.05$ ). Chi-squared analysis demonstrated no association between ambulance use and admission.

**Table 5** Appropriateness of ambulance use vs admission/severity coding.

<i>n</i>	Severity coding
23/97	No subsequent admission
15/97	Admission one day or less
16/75	Coded mild
23/91	Coded moderate
15/44	Coded ac. severe/severe
18/38	Coded severity not documented

nebulised, in spite of receiving nebulised therapy on transfer. Of those transferred by ambulance, only 23/97 were admitted and 15 of these stayed for less than 24 h. Chi-squared analysis showed no association between ambulance use and admission.

### A&E/MEAU assessment and care

Table 6 shows performance with regard to markers of severity in A&E/MEAU. There was no difference between A&E and MEAU. Although vital signs were recorded well, the PEFR was performed in only 67% of cases. Severity assessment on admission was rarely performed and ambulance therapy was generally disregarded. Table 7 shows the initial therapy in A&E/MEAU with half of the cases given oxygen, 84% given nebulised therapy and 65% corticosteroids of which 34% received hydrocortisone). Secondary therapy was used rarely and only 63% had any form of reassessment. Table 8 shows the outcome of cases discharged from A&E/MEAU, few have any of the recommended actions given in national guidelines although 62% of cases have a pre-discharge PEFR.

### In-patient care

Data was available from 99 admissions and Table 9 shows the performance against national guidelines. Few patients have the benefit of a specialist ward and only half have supervision by designated chest consultants. Objective assessment of daily severity was disappointing (59% of cases.) Discharge planning is shown in Table 9. Again there is poor performance against national criteria and in particular written management plans were given in only 13% of cases.

### Discussion

This national audit of all DGHs and teaching hospitals in Wales showed disappointing adherence to well established

**Table 6** A&E/MEAU – markers of severity – 248 cases.

	Average	Range	% Performed
PEFR	240	60–610	67
Pulse	101	60–173	95
R rate	24	14–48	85
O <sub>2</sub> saturation (%)	96.6	77–100	90
ABG			39 (performed in 96 cases)

**Table 7** A&E/MEAU – therapy (248 cases).

O <sub>2</sub>	138/248
Nebuliser	209/248 (145 salbutamol/ipratropium, 64 salbutamol)
Steroids	162/248 (55 hydrocortisone)
Secondary therapy	7/248 magnesium 7/248 aminophylline
Repeat observations	157/248 (63%)

No significant difference between treatment in A&E vs MEAU.

guidelines of care for acute asthma. We had estimated from previous patterns of admissions that some 300 cases would have been admitted in February 2006,<sup>10</sup> our data suggests that there is a diagnostic shift in the elderly population to a diagnosis of chronic obstructive pulmonary disease (COPD) as in this age group numbers of admissions were less than predicted. The wide age distribution, including substantial numbers of young patients (18–30 years), suggest that there is a failure to deliver appropriate care across the age range. Similar data has also been reported in the USA.<sup>11</sup> The female predominance of admissions has been commented on by others<sup>12</sup> and suggests targeting of this group would be potentially beneficial. The proportion of patients presenting with acute severe/severe asthma (18%), emphasised in previous studies,<sup>12</sup> suggests structured management plans are not having the impact promised.

The lack of use of the ambulance service in the transfer of asthmatics to hospital has been noted by others<sup>14,15</sup> and it was interesting to note that so few transfers were arranged by medical staff, suggesting the population is not accessing out of hours care appropriately. The lack of PEFR measurements by the ambulance staff (in spite of the provision of gauges in all ambulances) undermines the BTS/Sign assessment of severity, the consequence being the transfer of many mild cases to hospital and the widespread use of nebulisation irrespective of severity. There is now clear evidence<sup>16</sup> that the early use of corticosteroids is highly beneficial in the outcome of acute asthma and it is disappointing to see that only 5/72 patients had this therapy. There was, in addition, very little repeat measurement of vital signs by paramedic staff during ambulance transfer to hospital. An underlying factor in these results is the current Welsh Ambulance Service acute asthma protocol where it is presumed that all such patients are severe and transfer to hospital becomes mandatory. Negotiations on changes to this protocol are ongoing.

**Table 8** A&E/MEAU – outcomes measures (248 cases).

Discharge	135/248 stayed <24 h
Therapy	36% given steroids
Pre discharge PEFR	62%
Written management plan	13%
Early GP review	30%

No significant difference in outcomes A&E vs MEAU.

**Table 9** In-patient care – 99/248.

	%		%
Chest consultant care	51	Daily severity	59
HDU/ITU	0.04	Special nurse	37
Chest ward	32	Steroids <sup>a</sup>	85
Pre discharge PEFR	61	Nebuliser therapy	73
Converted to inhalers	61	Written management plan	13
OPD <sup>a</sup>	71	Early GP contact	35

<sup>a</sup> Both steroid use and OPD review were significantly associated with chest consultant supervision ( $p < 0.05$ ).

We were surprised that there was little difference in any of the major markers measured between A&E departments and MEAUs. There have been few performance studies of MEAUs<sup>17</sup> and our data suggests that in this common medical emergency there is no difference in outcomes. The performance in both A&E and MEAU was similar to other reported studies<sup>13,18,19</sup> showing disappointing results for severity measurements, over-use of nebulised bronchodilators and excessive administration of hydrocortisone. Of more concern was the lack of any definitive classification of severity. This is fundamental to BTS/Sign recommendations and it was rare to find any patient who had a formal statement of severity. The SpRs for this audit made an assessment based on clinical progress and the limited initial assessment data. Subsequent discharge from A&E/MEAU is similarly disappointing with only 62% of patients having any reassessment, a minority given written management plans<sup>20</sup> or the offer of formal out-patient review. A feature of management in both units was the disregard of any ambulance administered therapy. It was uncommon to have oximetry interpreted with due regard to oxygen therapy in the ambulance<sup>21,22</sup> and 80% of patients are immediately nebulised, in spite of having received this therapy during transfer. The current national British Accident & Emergency Medicine (BAEM) guidelines<sup>23</sup> are responsible for some of this inappropriateness of care with a recommendation of intravenous hydrocortisone for all asthmatics other than mild, the use of high flow oxygen and immediate nebulisation.

Similarly in-patient care for asthma is disappointing. Only half of the patients see a chest specialist, and one third see a specialist nurse or are nursed on a chest unit. Discharge planning is poor with adherence to guidelines disappointing particularly with regard to written management plans.

## Conclusion

Emergency asthma care in Wales is disappointing; there is little evidence of any improvement since the early 1990s and a fundamental review of the process of care for acute asthma is currently underway with a view to establishing a national protocol to cover all aspects of acute secondary care of asthma. The separation of ambulance, A&E, MEAU and in-patient care protocols is causing confusion in the structured care of acute asthma and there is a need to integrate care protocols between these service providers.

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### Conflict of interest statement

All authors declare that there is no conflict of interest relating to this article.

### Appendix A

FORM 1

**ADDENDUM 1**  
Audit Forms

**Wales Asthma Allergy and Immunology Research Unit  
Llandough Hospital  
AUDIT OF ACUTE ASTHMA ADMISSIONS FEBRUARY 2006**

<b>DETAILS OF PATIENT AT TIME OF ADMISSION</b>				
Hospital Number	Admission Date	Audit No Identifier		
Date of Birth	Discharge Date	Hospital:		
M/F				
<b>Route of Admission:</b>				
Ambulance	Self Referral	Other		
A&E Dept	Med. Admission Unit	Ward		
<b>Ambulance Clinical Record</b>		PCR No	Incident No	
Date of Call	Source of Call			
	EM Call			
	Dr EM Call			
	Urgent			
Time At Scene	Other	1 <sup>st</sup> Obs	2 <sup>nd</sup> Obs	
Time Left Scene	Trans			
Time At Hospital	Time: R. Rate Pulse Peak flow O <sub>2</sub> Sats BP			
<b>MEDICINE ADMINISTRATION</b>				
Oxygen - % conc				
Nebuliser	Y/N	Drug	Dose	
Steroids	Y/N	Drug	Dose	
Adrenaline	Y/N	Exn Code Completed	Y/N – If yes, state Medicine(s) & Code Number	

**Addendum 1****FORM 2**

**Wales Asthma Allergy and Immunology Research Unit  
Llandough Hospital  
AUDIT OF ACUTE ASTHMA ADMISSIONS FEBRUARY 2006**

<b>A&amp;E OR MEDICAL ADMISSION UNIT</b>					
Hospital No:	Admission Date:	Audit No Identifier			
Date of Birth:	Discharge Date:				
M/F	Hospital:				
Route of Admission	AMB/A&E/SELF REFERRAL/DR REFERRAL OTHER				
Was Diagnosis Asthma	Y/N	If not, ? COPD, PNEUMONIA, BRONCHITIS, HYPERVENTILATION, OTHER – STATE			
BTS SEVERITY GRADE:	MILD	MOD.	SEVERE	AC. SEVERE	
TIME OF ARRIVAL:	TIME SEEN:				
INITIAL ASSESSMENT OF SEVERITY:	PFR	PULSE	RESP.RATE	O <sub>2</sub> SATS OXIMETRY	ART.BL.GASES pH pCO <sub>2</sub> pO <sub>2</sub> O <sub>2</sub> sats
CHEST X-RAY	Y/N				
SMOKER	Y/N				
<b>IMMEDIATE MANAGEMENT :</b>					
O <sub>2</sub> /Litres/Min	Neb Drugs	Steroid Dose Route IV/Oral/Both		Inhaler/drug/device	
Antibiotics	Y/N	Adrenaline	Y/N/	IV Bronchodilators	Y/N IV Theophylline Y/N
<b>WAS REASSESSMENT CARRIED OUT : Y/N IF YES, MINUTES AFTER INITIAL ASSESSMENT</b>					
<b>OUTCOME</b>	PEAK FLOW RATE	Litres/min			
Discharge	Y/N	WRITTEN MANAGEMENT PLAN	Y/N	ADMITTED: MEAU/WARD EARLY G.P. REVIEW	
		INHALER TECHNIQUE CHECKED	Y/N	OPD REVIEW Y/N ? CHEST CONSULTANT/GENERAL PHYSICIAN	
		INHALED THERAPY	Y/N	TYPE	
		ORAL STEROID	Y/N		

**Addendum 1****FORM 3**

**Wales Asthma Allergy and Immunology Research Unit  
Llandough Hospital  
AUDIT OF ACUTE ASTHMA ADMISSIONS FEBRUARY 2006**

<b>INPATIENT CARE</b>				
HOSPITAL NUMBER	ADMISSION DATE	AUDIT NO IDENTIFIER		
DATE OF BIRTH	DISCHARGE DATE			
M/F	HOSPITAL			
UNDER CARE OF CHEST CONSULTANT	Y/N	ITU/HDU	Y/N	
SPECIALIST CHEST WARD	Y/N			
DAILY ASSESSMENT OF SEVERITY?	Y/N			
DRUG DURATION – NAME, DOSE, FREQUENCY				
NEB BD's	ORAL BD's	IV BD's	IV/ORAL STEROID	
INHALER TECHNIQUE CHECKED	Y/N			
SPECIALIST NURSE INVOLVEMENT	Y/N			
INHALED THERAPY ON DISCHARGE LIST:	ORAL STEROIDS ON DISCHARGE Y/N			
DOSE DURATION				
DISCHARGE PROCESS:		CAUSE OF EPISODE		
PEAK FLOW RATE	Litres/min	INFECTION		
CONVERTED TO INHALERS 24 HOURS PRIOR TO DISCHARGE		ALLERGIC		
WRITTEN MANAGEMENT PLAN		Y/N	DRUGS	
OPD REVIEW	Y/N	OCCUPATIONAL		
G.P. CONTACT	Y/N	ENVIRONMENTAL		
OTHER				

**ADDENDUM 1****INSTRUCTIONS FOR COMPLETING  
FORM 1**

**This form relates to the response the ambulance service gave to the patient. It is NOT for A & E or medical admission unit data apart from the hospital number.**

Use the yellow ambulance form – all the data should be on the form.

The PCR Number is at the top right hand corner of the ambulance form in red

The Incident Number is at the top of the left hand side of ambulance form and is up to an 8 digit number.

The Audit Number identifier will be allocated centrally.

EM CALL – a 999 call from member of public

Dr EM CALL – a 999 call or similar initiated by a health care professional

URGENT CALL – requested only from health care professional

OTHERS – via other sources

TRANS – was the ambulance delivering the patient from another health care unit

ASSESSMENTS – all should have been noted by ambulance staff

MEDICINE ADMINISTRATION – nebuliser bowls are Micro-Mist nebs.  
oxygen flow is currently 6 litres/min.  
note if Hydrocortisone IV is used.

EXN CODE – Identifies those cases where medicines were not given.

EXN CODE NUMBER – identifies the reason why



**ADDENDUM 1****INSTRUCTIONS FOR COMPLETING FORM 2**

**This form relates to assessment and care either in A & E or MEAU. If the patient is kept on MEAU over 24 hours, complete Form 3.**

Audit number identifier is allocated centrally

Was Diagnosis Asthma – this is important. Please give probable diagnosis for primary cause of attendance

**BTS SEVERITY GRADE**

Mild – Clinically stable and PFR >75% best or predicted

Moderate/ PFR > 33-75% best or predicted

Severe Resps > 25/min

Pulse > 110/min. Cannot complete sentences in one breath

Acute Severe – PFR < 33% best or predicted: SpO<sub>2</sub> < 92%

Silent chest, cyanosis, poor respiratory effort

arrhythmias, hypotension, exhaustion, confusion, coma

Time of Arrival/Time Seen – from triage time to Dr review

Outcome – The discharge process can only be accepted if it is written somewhere in the record

**ADDENDUM 1****INSTRUCTIONS FOR COMPLETING FORM 3**

**This form relates to care given if patient is in a hospital environment for more than 24 hours.**

Audit Number Identifier is allocated centrally

Chest consultant – This applies when patient is reviewed by Consultant or the firm’s junior staff.

Daily assessment of severity – this must be documented

Inhaler Technique – must be documented

Discharge Process – All should be documented in the case record

Written Management Plan – relates to a separate sheet outlining individual care for patient use (not the copy of the discharge letter)

OPD Review – has it been offered?

GP Contact - has early contact with GP been advised to patient or GP

Cause of Episode – we understand this may be difficult. Please try to give a reasonable guess!

If allergic - please specify

If drugs - please specify

If occupational - please specify

If environmental - please specify

If other - please specify

## Appendix B

**ADDENDUM 2**

## Total Number of Patients Admitted During February All Hospitals

HOSPITAL	Total Asthma Admissions	AC Severe	Severe	Moderate	Mild	Not Doc	Excluded Patients
Ysbyty Gwynedd	9	0	2	4	3	0	0
Glan Clwyd	13	0	1	3	0	9	1
Wrexham Maelor	23	1	6	6	5	5	1
Neville Hall	8	0	0	2	4	2	0
Bronglais	14	1	6	6	1	0	0
Royal Gwent	35	3	4	16	12	0	4
UHW	22	1	3	3	9	6	1
Llandough	6	0	0	3	2	1	0
Bro Glamorgan	11	0	2	6	2	1	1
Neath/Port Talbot	6	0	1	2	2	1	2
Singleton	11	0	1	4	6	0	3
Morrison	12	0	0	9	2	1	5
Prince Phillip	25	2	1	7	6	9	0
Withybush	10	0	2	3	3	2	3
Glangwili	14	4	1	3	5	1	8
Prince Charles	8	0	0	3	5	0	3
Princess of Wales	21	2	0	11	8	0	4
<b>TOTAL</b>	<b>248</b>	<b>14</b>	<b>30</b>	<b>91</b>	<b>75</b>	<b>38</b>	<b>36</b>

Total Entered 284

Total Asthmatics 248

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