

Psychosocial risk factors in near-fatal asthma and in asthma deaths

ABSTRACT *Background:* A description of near-fatal asthma (NFA) and comparison with patients who died of asthma in an English health district between 1988 and 1995.

■ *Methods:* The hospital case notes of patients aged under 65 years with NFA, identified from the intensive therapy unit register, were reviewed using forms based on those of the East Anglian confidential asthma death enquiry. Details were compared with patients dying from asthma in the same population during the same period.

■ *Results:* Between 1988 and 1995, 19 patients suffered 23 episodes of NFA and 44 died from asthma. Those with NFA were significantly younger. There were more women in both groups. Two patients with NFA subsequently died of asthma. Significantly more patients with NFA had had a previous NFA episode than those who died. Five had a cardio-respiratory arrest. Thirteen required intermittent positive pressure ventilation (IPPV). $Paco_2$ ranged from 6.1 to 17.8 kPa; nine had $Paco_2 \geq 10$ kPa and three recovered without IPPV. Adverse psychological and social factors were similar in both groups. Denial was the commonest psychological factor and domestic, financial or employment stress, smoking or passive smoking the commonest adverse social factors; only two with NFA and seven who died had no recorded adverse psychological or social factors.

■ *Conclusions:* NFA and deaths from asthma occur in asthmatics who have many psychosocial risk factors in common. Special attention needs to be directed at patients with these adverse psychosocial factors, emphasising that they need continued follow-up with support to help them manage their asthma according to currently recommended practice.

Most recent studies on near-fatal asthma (NFA) episodes have focused on their physiological aspects¹⁻³ and environmental associations⁴⁻⁶, but several studies from South Australia⁷ and Canada⁹ have looked at the psychological associations found in patients experiencing such attacks. In a recent review of NFA¹⁰, Molfino and Slutsky made only a passing reference, in a table, to the adverse psychological, emotional and social context of NFA and referred to only one paper⁵.

Since 1988 we have been conducting a confidential enquiry into asthma deaths in Norwich¹¹ and East Anglia¹².

The most striking findings are that 54 of the 60 deaths occurred before admission to hospital, and that three-quarters of those who died from their asthma had adverse psychological and/or social factors^{11,12}. As there have been no recent British studies of NFA, nor any comparisons of NFA with asthma deaths in Britain, we have performed a retrospective review of patients aged 15 to 65 years admitted to our hospital with NFA since 1988 and compared them with the 44 patients aged 15 to 65 years who died from asthma in our health district during the same eight years.

Methods

NFA was defined as an episode of asthma in a patient admitted to the intensive therapy unit (ITU) and requiring intermittent positive pressure ventilation (IPPV) with raised inflation pressures, or admitted to the ITU with a raised (>6.0 kPa) arterial carbon dioxide tension ($Paco_2$) but recovering without IPPV. Arterial blood gases were measured in all patients admitted with severe asthma¹³. It is our policy to transfer all asthmatics who have a raised $Paco_2$ on admission, or who develop a raised $Paco_2$ during admission, to the ITU¹³ and our criteria for IPPV are as recommended by the British National asthma guidelines¹³.

We reviewed the case notes of all patients admitted to the ITU with a diagnosis of asthma between 1988 and 1995. Those aged 15 to 65 years who either before or after the ITU admission were confirmed to have asthma (characteristic history and at least 15% variability or reversibility in peak expiratory flow (PEF), or forced expired volume in one second (FEV₁)) and who fulfilled the definition of NFA, were included. Patients who had smoked and who were shown to have irreversible chronic obstructive pulmonary disease (COPD) were excluded. Forms based on those used in the confidential asthma death enquiry for reviewing the hospital records¹² were used to abstract the data from the patients' hospital notes. Data from general practice records and next of kin interviews were not included in this study. We compared results with those obtained from our hospital note review in the confidential enquiries into asthma deaths^{11,12}.

Psychosocial factors

Denial was accepted as a factor when recurrent non-attendance at scheduled outpatient appointments, self-discharge from hospital, non-compliance with medication or management, or unwillingness to accept the diagnosis of asthma, were recorded in the notes. Depression was

N J INNES MB MRCP, Registrar

A REID MB MRCP, Registrar

J HALSTEAD MB BChir, House physician

S W WATKIN MD MRCP, Consultant physician

B D W HARRISON MB FRCP, Consultant physician

Department of Respiratory Medicine, Norfolk and Norwich Hospital, Norwich

accepted when that diagnosis was recorded or the patient was receiving antidepressant medication. The other factors listed in Table 3 had to be recorded in the patient's hospital notes before they were accepted as relevant factors.

Results

Our hospital and ITU serve a population of around half a million in the county of Norfolk. Forty-four patients aged 15 to 65 years died of asthma in this population during the eight years of this study. In the same period there were 23 episodes of NFA in 19 patients aged 15 to 65 years. Two women were admitted twice and one woman three times with NFA. One woman and one man with NFA subsequently died of asthma during the period of the study; the woman was admitted after a respiratory arrest and died of hypoxic brain injury, and the man died at home. The annual numbers of deaths and NFAs are shown in Fig 1. In each year except 1991 deaths exceeded NFAs. Details of the two groups are given in Table 1. Those admitted with NFA were significantly younger than those who died (unpaired T-test; $p < 0.005$). There were no significant differences between the two groups in the proportion with previous admissions, or attending respiratory medical outpatients. Significantly more patients with NFA had had a previous NFA than those who died ($\chi^2 = 14.15$; $p < 0.01$).

In 18 of 22 episodes of NFA, where this could be assessed from the notes, there had been a notable deterioration in asthma several hours or days before admission; in 14 of 21 cases the patients had under-estimated the severity of their asthma as manifest by delaying or failing to increase treatment after deteriorating, or failing to call for medical help when appropriate. Five had a cardio-respiratory arrest before their admission to the ITU. Thirteen required intermittent positive pressure ventilation (IPPV) and ten were admitted to the ITU but recovered without IPPV. Physiological data are summarised in Table 2. Nine patients had

Table 1. Details of patients aged under 65 years who died of asthma or who experienced a near-fatal attack of asthma between 1988 and 1995.

	Deaths	NFA
Number	44	23 (in 19 patients)
M:F	16:28	6:13
Age (range)	46 (17-63)	35 (14-57)*
Previous admissions for asthma	29	16/19
Previous NFA	3	9/19**
Currently attending respiratory outpatients	24	11/19

* $p < 0.005$
** $p < 0.01$

Table 2. Twenty-three episodes of NFA in 19 patients.

	IPPV	Not ventilated
Number	13	10
$Paco_2^*$ (kPa) mean (range)	11.2 (6.5-17.8)	9.1 (6.1-16.5)
pH* mean (range)	7.04 (6.74-7.4)	7.15 (6.87-7.29)

*on admission or on transfer to ITU

$Paco_2$ of 10 kPa or greater. Three of these, who had no impairment of consciousness and were not severely hypoxic, receiving oxygen by face mask, recovered with intensive medical treatment and did not require IPPV. All but one who did require IPPV were acidotic and 18 had pH below 7.25. Patients treated with IPPV had a higher $Paco_2$ and a lower pH before transfer to the ITU (Table 2) but neither of these differences was statistically significant.

The adverse psychological and social factors recorded in the hospital notes of those who died and those admitted with NFA are compared in Table 3. Only seven of those who

Table 3. Adverse psychological and social factors recorded in the hospital notes.

	Deaths (n=42)	NFA (n=19)
- Denial (reflected by non-attendance at appointments, self-discharge, non-compliance)	18	8
- Depression, or being prescribed antidepressants, substance abuse, self harm	4	2
- Obesity	13	3
- Domestic stress, financial stress	11	6
- Homeless, living alone, poverty	9	—
- Unemployed, self-employed	9	4
- Current smoker, passive smoker	9	6
- Separated, single parent	4	3
- Educationally subnormal	1	—
- No adverse psychosocial factors	7	2

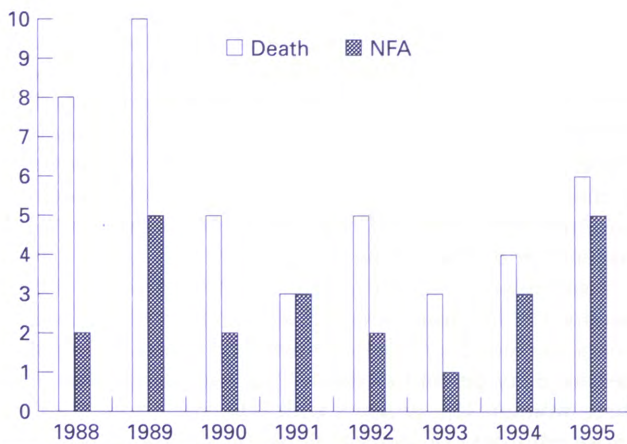


Fig 1. Annual numbers of deaths from asthma and patients admitted with NFA in Norfolk between 1988 and 1995.

died and two with NFA had no adverse psychological and/or social factors. The commonest factor was denial. Domestic, employment or financial stress, and smoking or passive smoking were recorded in the notes of an important minority in both groups. Patients who had a period of deterioration of three hours or longer before admission had over twice the number of adverse psychosocial factors than those who did not delay calling for help ($p=0.01$).

Discussion

Most patients who die of asthma do so in the community and before reaching hospital^{11,12} whereas patients with NFA are, by definition, admitted to hospital. In Britain, this admission will usually be under the duty general physician. It is essential that patients with life threatening asthma¹³ or NFA are recognised and transferred to the ITU according to recommendations in the guidelines¹³. The prognosis of patients admitted to the ITU with NFA is good except when the admission is precipitated by a cardio-respiratory arrest.

In our studies of asthma deaths, and in the present study of NFA, we excluded patients aged 65 years or older because of the confounding effects in the older age groups of chronic obstructive pulmonary disease (COPD) due to smoking. The diagnosis of asthma was reviewed by the authors and confirmed if patients had a characteristic history of asthma with appropriate physical signs and objective evidence of variable or reversible airways obstruction.

The levels of hypercapnia and respiratory acidosis in our patients are similar to those in previous studies^{2,3}. Molfino *et al*² concluded that the near-fatal nature of the exacerbations in their patients was the result of severe asphyxia rather than cardiac dysrhythmias. All the patients in the Argentinian², French¹⁴ and South African¹⁵ and eight of those in the Japanese³ studies were ventilated. As our experience and that in Australia¹ and Japan³ shows, not all patients admitted with NFA and hypercapnia and acidosis require IPPV provided there is no impairment of consciousness and they are not hypoxic.

Turning now to studies of psychological factors in NFA, Yellowlees and Ruffin⁷ studied 25 patients with NFA (19 women) with a mean age of 34 years. Twenty-one had had previous admission with their asthma, eight with previous episodes of NFA. The patients were assessed 13 months following the NFA and 40% were found to have psychiatric disorders. All the patients had high levels of denial which was assessed using the Illness Behaviour Questionnaire (IBQ); after the NFA, the patients either increased their levels of denial or developed symptoms of anxiety disorders.

In a more recent report⁸ the South Australian group studied the psychiatric profiles of 77 patients with NFA with a mean age of 38 years and male/female ratio of 1.4:1. They found a high proportion (43%) had a score of 5 or more on the General Health Questionnaire (GHQ), indicating psychiatric caseness, which was associated with high levels of

morbidity from asthma. They also reported high levels of denial, again using the IBQ, in 57% of patients and there was a correlation between sudden collapse as the mode of presentation with NFA and denial score. They suggested that patients with high levels of anxiety were more likely to present early in a severe attack of asthma whilst those with high denial scores were more likely to ignore the warning features of a developing attack of asthma and present later with sudden collapse. In the Saskatchewan Asthma Epidemiology Project current or recently discontinued use of major tranquillisers was associated with an increased risk of death or near death⁹.

In Norfolk we have also found evidence of denial, this time based upon a record in the notes of non-attendance, self-discharge or non-compliance, in 44% of patients with NFA and 43% of patients who died of asthma. Patients who delayed seeking medical help also had significantly more adverse psychosocial factors. Overt psychiatric diagnoses or deviant behaviour, recorded in the notes, were less common than in Australia. Our previous studies were the first to emphasise the importance of adverse social factors in patients dying from asthma^{11,12} and in this study we have found similar problems, notably domestic or financial stress, being a smoker or passive smoker and/or problems with employment, in patients with NFA. Only 17% of those who died and 11% of those with NFA had no adverse psychological or social factor recorded in their notes. As Garrett and Kolbe have commented, reliance on data recorded in a patient's notes almost certainly leads to an underestimation of the importance of adverse psychological or social factors in contributing to NFA or death from asthma¹⁶.

Other studies in adults¹⁷, adolescents^{18,19} and children¹⁹ with NFA have found poorly controlled asthma, reduced compliance with treatment, less adaptive personality characteristics and more psychological disturbances¹⁷, severe psychosocial problems¹⁸ and denial, psycho-social pathology and delay in seeking care¹⁹.

Two groups²¹⁷ have compared patients with NFA with a matched control group of asthmatics who had not experienced NFA. Yellowlees and Ruffin⁷ found patients with NFA had higher denial scores and Boulet *et al*¹⁷ found patients with NFA had reduced compliance with treatment, less adaptive personality characteristics and more psychological disturbances than the controls. Another study found no difference in the characteristics of patients with NFA and those hospitalised without a near-fatal event²⁰. However their retrospective study failed to account for 64% of the patients with NFA and required co-operation from the patients for their inclusion in the study.

Two previous studies have compared NFA and asthma deaths. The first from New Zealand²¹, in patients aged 15–49 years, included 413 patients with NFA and 466 asthma deaths. Sixty percent of the former and 54% of the latter were women. The patients with NFA were younger than those who died of asthma. Between 1984 and 1987 ICU admissions for asthma generally exceeded deaths from asthma in Auckland. The authors of that study concluded that

outcome for patients experiencing NFA is dependent on the time to reach medical care, and that these patients arise from the same high risk sub-group as those who die of asthma and that the younger age of the NFA group is explained by the greater physiological reserves of younger people. Campbell *et al*²² studied 154 NFA episodes and 80 deaths at all ages in South Australia. Forty-three percent of the NFA were women, compared with 61% of those who died. The NFA group were younger, with a mean age of 36 years, compared with the patients who died, whose mean age was 52 years. They found marked similarities between the two groups in frequency of symptoms, frequency of hospital and intensive care unit admission for asthma, the use of asthma crisis plans, compliance with prescribed medications, quality of personal asthma management and asthma severity. Each group had a similar frequency of previous psychiatric consultation (17% of NFA and 22% of those who died) and a similar frequency of a psychiatric history in first degree relatives (14% NFA and 21% deaths). They concluded that 88% of the NFA cases and 86% of the deaths had psychosocial features that could have contributed to their asthma episode. Those who died were more likely to experience delay in actually receiving medical care during the final episode. The authors of this study also concluded that asthmatics dying from asthma share many important characteristics with patients experiencing NFA. Sixty-five percent of NFA cases and 73% of asthma deaths were classified as having severe asthma and 45% of NFA and 39% of asthma deaths had been admitted to hospital in the preceding 12 months for their asthma. They identified high levels of denial and prior psychiatric morbidity in both groups and concluded that these factors should be addressed in future intervention studies. Our findings are similar to those in South Australia, with one important difference. Asthma deaths in our population were higher than NFA in seven of the eight years of our study but the age differences between the two groups in Norwich and South Australia are almost identical. We also found that nearly half the patients with NFA had had previous episodes of NFA; during the eight years of the study one woman was admitted three times with NFA. Studies of fatal and near-fatal asthma from tertiary referral centres in Japan²³ and the USA²⁴ concluded that adverse outcomes were associated with poor asthma care and low socioeconomic status.

One earlier study in Britain²⁵ looked at the long-term outcome of 50 patients (31 women) aged from 21 months to 80 years, ventilated for asthma over a 14-year period in one hospital. Five subsequently died of asthma and ten were ventilated on more than one occasion. Only 27% required no further admissions for their asthma. Peak flow recordings in those who survived showed that many continued to have poorly controlled disease.

Careful follow up of these patients is very important. In France Marquette *et al*¹⁴ found that specialised outpatient management, including regular review by pulmonary physicians and assessment of pulmonary function, was surprisingly infrequent in this group of patients. In South

Africa Kallenbach *et al* reported evidence of considerable undertreatment in their patients with NFA¹⁵. Molfino *et al*²⁶ found that two of the five patients who refused regular specialist follow-up had died, whilst all seven who had agreed to the follow-up survived. They felt that the careful follow-up, high doses of inhaled steroids and peak flow monitoring had contributed to the better outcome, and felt that in addition to rapid admissions services, such patients might be helped by greater involvement of their families, improved education of the patients, and home visits on a regular basis by medical personnel.

Ruffin *et al*¹ also concluded that careful follow-up with increased monitoring and prescription of anti-inflammatory treatment, which was associated with decreased bronchial hyper-reactivity, plus an awareness of the importance of denial in affecting outcome adversely, and a mechanism for ensuring reminders to patients who forget or do not comply with the follow-up regime, all contributed to improving the outcome in this group of patients. No deaths occurred in a mean follow-up period of 863 days. Our results support these and other studies^{3,8} which have shown that previous admissions to hospital, particularly admission with NFA, are predictors of further episodes of NFA and also of death from asthma.

We agree with Campbell *et al*⁸ that physicians managing patients with asthma, especially those experiencing NFA, need to be aware of psychiatric and psychosocial features which may interfere with that management and that attempts should be made to modify high levels of denial.

Several authors have commented on the triggers associated with attacks of NFA. These include allergens⁴⁻⁶, infections⁵, air pollution²⁷, weather changes^{28,29} and drugs³⁰, all of which induce attacks that are often unexpected. Others have emphasised emotional upsets⁵. Our results have highlighted the systematic importance of adverse psychological and also social factors. They support studies from Australia and New Zealand in drawing attention to these aspects of the lives of some asthmatics which merit greater attention from, and recognition by, doctors and nurses.

Conclusions

This observational study has confirmed reports from Australia and New Zealand that adverse psychological factors are frequently found in patients with NFA. We have demonstrated that adverse social factors are also common. The frequency of adverse psychosocial factors in NFA is similar to that found in patients dying from asthma. In other words the two outcomes, death from asthma and NFA, occur in patients with very similar and recognisable characteristics. The main differences between the two groups are that patients with NFA are younger and reach appropriate medical care more quickly.

We believe that patients with asthma who have social isolation or deprivation, extreme domestic, financial or employment stress, or adverse psychological features, especially those exhibiting denial or with overt psychiatric

illnesses or receiving treatment for these, deserve extra medical and nursing care and attention¹². We conclude that patients with NFA should be followed up by a specialist respiratory physician, probably indefinitely, because of the high recurrence rate of NFA and the potentially fatal outcome. Particular attention should be directed at supporting these patients, not only by monitoring and treating their asthma, especially with anti-inflammatory medication, but also by developing more helpful coping strategies.

Acknowledgements

We acknowledge the high quality nursing and medical care given to these patients in the Elizabeth Fry Unit and thank Mrs Alison Neale and Mrs Marion Jaques for their invaluable secretarial support.

References

- 1 Ruffin RE, Latimer KM, Schembri DA. Longitudinal study of near-fatal asthma. *Chest* 1991;**99**:77-83.
- 2 Molfino NA, Nannini LJ, Martelli AN, Slutsky AS. Respiratory arrest in near-fatal asthma. *N Engl J Med* 1991;**324**:285-8.
- 3 Kikuchi Y, Okabe S, Tamura G, Hida W, et al. Chemosensitivity and perception of dyspnoea in patients with a history of near-fatal asthma. *N Engl J Med* 1994;**330**:1329-34.
- 4 Anto JM, Sunyer J, Rodriguez-Roisin R, Suarez-Cevera M, Vasquez L. Community outbreaks of asthma associated with inhalation of soyabean dust. *N Engl J Med* 1989;**320**:1097.
- 5 Wasserfallen JB, Schaller MD, Feihl F, Perret CH. Sudden asphyxic asthma; a distinct entity? *Am Rev Respir Dis*. 1990;**142**:108-11.
- 6 O'Hallaren MT, Yunginger JW, Offord KP, Somers MJ, et al. Exposure to an aeroallergen as a possible precipitating factor in respiratory arrest in young patients with asthma. *N Engl J Med* 1991;**324**:359-63.
- 7 Yellowlees PM, Ruffin RE. Psychological defences and coping styles in patients following a life-threatening attack of asthma. *Chest* 1989;**95**:1298-1303.
- 8 Campbell DA, Yellowlees PM, McLennan G, Coates JR, et al. Psychiatric and medical features of near fatal asthma. *Thorax* 1995;**50**:254-9.
- 9 Joseph KS, Blais L, Ernst P, Suissa S. Increased morbidity and mortality related to asthma amongst asthmatic patients who use major tranquilisers. *Br Med J* 1996;**312**:79-82.
- 10 Molfino NA, Slutsky AS. Near-fatal asthma. *Eur Respir J* 1994;**7**:981-90.
- 11 Wareham NJ, Harrison BDW, Jenkins PF, Nicholls J, Stableforth DE. A district confidential enquiry into deaths due to asthma. *Thorax* 1992;**48**:1117-20.
- 12 Mohan G, Harrison BDW, Badminton RM, Mildenhall S, Wareham NJ. A confidential enquiry into deaths caused by asthma in an English health region: implications for general practice. *Br J General Practice* 1996;**46**:529-32.
- 13 British Thoracic Society and others. Guidelines on the management of asthma. *Thorax* 1993;**48**:S1-S24.
- 14 Marquette CH, Saulnier F, Leroy O, Wallaert B, et al. Longterm prognosis of near-fatal asthma. A 6-year follow-up study of 145 asthmatic patients who underwent mechanical ventilation for a near-fatal attack of asthma. *Am Rev Respir Dis* 1992;**146**:76-81.
- 15 Kallenbach JM, Frankel AH, Lapinsky SE, Thornton AS, et al. Determinants of near fatality in acute severe asthma. *Am J Med* 1993;**95**:265-72.
- 16 Garrett JE, Kolbe J. Near fatal asthma in South Australia: descriptive features and medication use. *Aust NZ J Med* 1996;**26**:487-9.
- 17 Boulet LP, Deschesnes F, Turcotte H, Gignac F. Near-fatal asthma: clinical and physiological features, perception of bronchoconstriction and psychological profile. *J Allergy Clin Immunol* 1991;**88**:838-46.
- 18 Niggemann B, Wahn U. Three cases of adolescent near-fatal asthma: what do they have in common? *J Asthma* 1992;**29**:217-20.
- 19 Martin AJ, Campbell DA, Gluyas PA, Coates JR, et al. Characteristics of near-fatal asthma in childhood. *Pediatr Pulmonol* 1995;**20**:1-8.
- 20 Kesten S, Chew R, Hanania N. Health-care utilization after near-fatal asthma. *Chest* 1995;**107**:1564-9.
- 21 Richards GN, Kolbe J, Fenwick J, Rea HH. Demographic characteristics of patients with severe life threatening asthma: comparison with asthma deaths. *Thorax* 1993;**48**:1105-9.
- 22 Campbell DA, McLennan G, Coates JR, Frith PA, et al. A comparison of asthma deaths and near-fatal asthma attacks in South Australia. *Eur Respir J* 1994;**7**:490-7.
- 23 Kunitoh H, Yahikerzawa H, Kakuta T, Ono K, et al. Fatal and near-fatal asthma. *Ann Allergy* 1992;**69**:111-5.
- 24 Corn B, Hamrung G, Ellis A, Kalb T, Sperber K. Patterns of asthma death and near death in an inner-city tertiary care teaching hospital. *J Asthma* 1995;**32**:405-12.
- 25 Matiti HH, Grant CD, Davidson AG. Audit of long-term outcome of near fatal asthma. *Thorax* 1991;**46**:776.
- 26 Molfino NA, Nannini LJ, Rebuck AS, Slutsky AS. The fatality prone asthmatic patient. Follow-up study after near-fatal attacks. *Chest* 1992;**101**:621-3.
- 27 Bates DV, Baker-Anderson M, Sizto R. Asthma attack periodicity: a study of hospital emergency visits in Vancouver. *Environ Res* 1990;**51**:51-70.
- 28 Weiss KB. Seasonal trends in US asthma hospitalization and mortality. *J Am Med Assoc* 1991;**263**:2323-8.
- 29 Thames Regions Accident and Emergency Trainees Association, Davidson CA, Emberlin J, Cook AD, Venables KM. A major outbreak of asthma associated with a thunderstorm: experience of accident and emergency departments and patients' characteristics. *Br Med J* 1996;**312**:601-4.
- 30 Picardo C, Castillo JA, Montserrat JM, Auguste-Vidal A. Aspirin intolerance as a precipitant factor of life-threatening attacks of asthma requiring mechanical ventilation. *Eur Resp J* 1989;**2**:122-9.

Address for correspondence: Dr B D W Harrison, Department of Respiratory Medicine, Leicester House, Norfolk and Norwich Hospital, Brunswick Road, Norwich NR1 3SR.