which can be written out by hand, filled in on preprinted forms, or summarised on cards the size of credit cards. The National Asthma Campaign provides free booklets (booklet number 7) on peak flow monitoring and self management plans, which include space for a doctor or nurse to fill in either a three step or a four step plan. They also include a reminder plan, the size of a credit card, which can be removed from the main book of instructions and carried by the patient or kept with the peak flow meter.

We do not know how many patients with asthma currently have self management plans. Two in five calls to the National Asthma Campaign's telephone helpline concern peak flow¹⁰; apparently many callers with asthma have received a peak flow meter but little advice on what to do with it. Often peak flow monitoring is perceived as something to do for the doctor rather than as a procedure designed to give patients control of their condition. The national audit of attacks of asthma in Britain in 1991-2 found that only 29% of patients had their own peak flow meter; of those who had experienced an asthma attack in the past year only 41% had a self management plan.¹¹

Initial uncontrolled evaluation of self management plans seemed to show that they reduced morbidity.¹² A subsequent preliminary report by the Wellington asthma research group on the use of action plans showed that after 69 Maoris were given credit card sized management plans there was a significant rise in mean peak flow, and a fall in the number of nights of sleep disturbed by asthma.¹³ Such plans may well work by giving the patients a feeling of "being in control" and this alone may be sufficient to increase compliance. Several American studies of self management plans given to adults within the context of wider educational programmes have also shown benefits.¹⁴⁻¹⁶ In children similar educational efforts can influence the self management behaviour of parents,¹⁷ and many parents find home peak flow monitoring helpful in recognising severe asthma attacks.¹⁸

However, in this issue of the *BMJ* is a study drawing attention to the need for further clarification before widespread community monitoring by children can be recommended (p 572).¹⁹ In adults as well, attention has been drawn to several unknowns regarding self management.²⁰ These relate to the need to define better who needs a peak flow meter, who needs a self management plan, and what steps and interventions the plans should contain. Studies from Aberdeen also reported in this week's *BMJ* confirm that individualised

patient education and written advice can reduce hospital admissions and reduce morbidity (p 559),²¹ but the self management plans are probably most likely to benefit those with more severe asthma (p 564).²² It therefore seems sensible to ensure that all patients with asthma have both verbal and written advice about asthma, with that advice being tailored for each individual. Detailed self management plans and peak flow meters should be given, as a minimum, to adults with severe asthma, to those with variable disease, and to those who have been admitted to hospital because of asthma.

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Peak flow meters: a problem of scale

Wait for an international standard before changing scale

Martin Wright and colleagues pioneered the measurement of peak expiratory flow in the late 1950s and produced small, mechanically based, hand held meters.^{1,2} The use of this measure of lung performance has recently come to the fore with the promotion of self management plans for asthma that base advice about treatment on changes in peak flow.^{3,5} This has focused attention on the meters' performance, and concern now exists about their accuracy.

The peak flow meters added to Britain's drug tariff in 1990 are robust and give consistent readings. The first evidence questioning their accuracy was presented to the British Thoracic Society more than three years ago,⁶ and these findings have subsequently been confirmed.^{7,8} Although the

meters give reasonably accurate readings at low flows, they may overread by about 70 l/min in the middle of the range and underread by about 50 l/min in the high range. Some people may deem that an error of 15% is acceptable for such low cost meters, but the problem is that the inaccuracy varies across the range of the meters, so that assessing change in peak flow, which the asthma management protocols require, is distorted.

This distortion is not the same for all patients and depends on which part of the meter's range the subject's peak flow varies over. For example, meters will overestimate the variability in peak flow in subjects whose peak flow varies from the mid range downwards; subjects whose peak flow varies from the top down towards the middle of the range will

have their variability underestimated. This false estimation of variability is biased in such a way that asthmatic patients whose peak flow varies in the lower range are more likely to have to increase their treatment, given the current self management protocols. Arguably, the error tends to "fail safe," rather than expose the patients with the most severe asthma to undue risk.

But when changes in peak flow are used for diagnosis or as a criterion for discharge from hospital or an accident and emergency department then the errors inherent in these meters may lead to the wrong decisions. Preliminary findings from a recent study have indicated that correcting for this inherent inaccuracy in the meters substantially increases the number of interventions that would be made if self management plans were used.⁹

The meters' inaccuracy has not been due to any oversight by designers or manufacturers. No absolute standard exists for measuring the flow of gas, and when these meters were first produced they were calibrated with the best means available. Over the years manufacturers have been careful to ensure that new meters give readings as close as possible to those of the original meters. Technological advances have made it possible to produce pump systems that can generate dynamic flows of gas with greater accuracy than before, and this equipment has revealed the inaccuracies.

Since the problem with the meters' scales came to light manufacturers have produced peak flow meters with adjusted scales by using a standard calibrating system that was originally designed for testing spirometers.¹⁰ But this may not be appropriate for testing apparatus that records the rapid phenomenon of peak flow. Although it is relatively easy to improve a meter's accuracy by adjusting the scale, the main problem lies in defining the absolute standard of flow that all meters should meet and how to verify it. Work has already started on behalf of the European Commission to establish an agreed standard for flow generation, and a final standard scale for meters is expected within a year or so.

In the meantime, should peak flow meters continue with the current original scales, which formed the basis of the present self management schemes, or change to one of the arbitrary standards available? For self management plans the current scales will not judge every asthmatic patient's condition identically. Patients become familiar with how their peak flow readings vary, and this, together with the use of a symptom based management plan,⁴ should continue to result in improved asthma supervision. When peak flow meters are used to test for a threshold for discharge from hospital or an

accident and emergency department or are used for diagnosis then corrections should be made for the meters' inaccuracy. A mathematical correction for the errors can be made, but the formula is slightly different for each brand of meter and is too complex for simple mental arithmetic. Small calculators have already been produced to give predicted values for peak flow, so similar devices or a chart that corrects peak flow meters' readings might be helpful until the single standard is achieved.

Doctors have so far managed with the current scales derived from an arbitrary standard and have found in clinical trials that these meters improve the management of asthma. Concern exists that if any new arbitrary standard was adopted then experience with the changed meters would be accrued with no certainty that this was the best and final standard for such meters. Thus a change now to a new arbitrary standard might give peak flow readings closer to the truth, but the later establishment of a new international standard would lead to additional upheaval. As there are several million peak flow meters in use worldwide all efforts should be toward a single and final change in scale. The alternative is several different scales and adjustments before an international standard is agreed, causing increasing confusion among patients and their doctors.

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Non-heart beating donors as a source of kidneys

May help, but we should try harder with heart beating donors

In 1981, 814 cadaveric renal grafts were given to patients in the United Kingdom, a rate of 14.2 per million population. By 1989 the rate had more than doubled to 30.1 per million population, or 1728 cadaveric grafts. However, no further increase was recorded in the next three years, in which 1735, 1628, and 1640 cadaveric renal grafts were reported to the United Kingdom Transplant Support Service Authority. At the end of each of these three years the numbers of patients on the authority's waiting list for the United Kingdom were 3666, 3960, and 4361—an average annual growth approaching 10%.¹ For these patients who are waiting and for the

transplant teams eager to help them the mood is approaching desperation.

Most organ donations come from patients on ventilatory support in intensive care units and in whom the criteria of brainstem death have been confirmed according to the rules laid down by the royal colleges.² Such patients are the best source of cadaveric organs for transplantation, which are associated with a graft survival at one year of over 80%, but they supply insufficient numbers. A shortage of intensive care beds undoubtedly influences decisions on whether to ventilate patients who are comatose after cerebrovascular accidents.