

meant. However, by working in the developing world we can improve our own understanding of, and more readily empathise with, the problems of others, perhaps help a little to resolve some of their suffering and in the process learn a great deal that will be of personal and professional value in years to come. I would urge any doctor who feels motivated towards working in the developing world to take the plunge. The benefits are enormous.

Commentary

Dr Williams' experience of a period in the Sudan will bring back memories to many others

who have had the privilege of helping for a period in the developing world. I was, however, sorry he did not have the opportunity to visit the resource centre set up specifically to help such individuals at the Centre for International Child Health in the Institute of Child Health.

Since Professor Andrew Tomkins has taken over the responsibility of the unit, the material in the resource centre has been extended and is being updated. Paediatricians going overseas will always be welcome.

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Measuring compliance with inhaled medication in asthma

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Abstract

Using an electronic inhaler timer device (Nebulizer Chronolog), compliance with the prescribed frequency of inhaled prophylactic medication in 14 asthmatic children was measured. Underuse occurred in 55% of study days while overuse occurred in only 2%. Such devices provide an important new tool for investigating inhaled drug compliance.

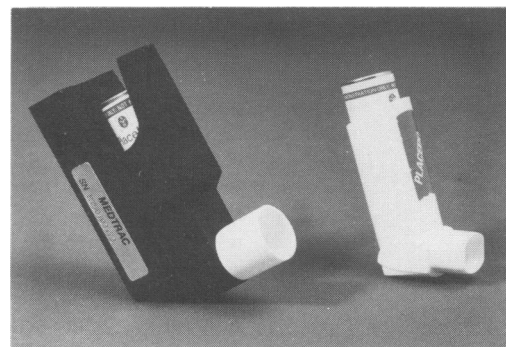
Asthma continues to be a major and rising cause of morbidity in childhood,¹ despite advances in drug treatment and escalating prescription of antiasthma medication.² Poor response to treatment may occur for many reasons but one increasingly recognised problem is failure to adhere to the prescribed treatment. This may be especially important in asthma where good symptom control often depends on the patient taking regular preventative medication.

Previous studies in asthmatic subjects have pointed to poor compliance with treatment. However, the methods described have either been indirect, such as prescription uptake, or have averaged the effects of drug taking over time as with monitoring drug concentrations.

More recently, inhaler timer devices have been developed. One example, the Nebulizer Chronolog (Forefront Technologies Inc, Lakewood, Colorado), electronically counts and times each actuation of a metered dose inhaler (MDI). This device replaces the normal plastic inhaler holder (figure) and can be used with all types of aerosol canisters allowing direct monitoring of inhaler use.

prophylactic treatment in children (n=14; age 9–16 years; M:F 6:8). All had moderate to severe asthma, were using MDIs, were being treated with prophylactic inhaled corticosteroids, and were judged to have satisfactory inhaler technique. Verbal consent for the study was obtained from the children and their parents. All were aware that the device would 'count' the number of actuations but, in general, were not aware of the precision of the recording. The subjects were issued with an initialised Nebulizer Chronolog and a diary card with instructions to score their daily symptoms and note their inhaler use.

After one to three months the Nebulizer Chronolog and diary cards were returned. The information stored in the device was read and analysed by dedicated computer software and a report, detailing medication use, prepared. For each individual patient day, the prescribed use, recorded use (Nebulizer Chronolog), and reported use (diary card) of prophylactic medication were compared. A 'compliant day' was defined as one in which the prescribed number of puffs were taken at appropriate times.



A Nebulizer Chronolog compared with a standard metered dose inhaler.

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Methods

We used the Nebulizer Chronolog in a pilot study investigating compliance with inhaled

Compliance of children with prophylactic inhaled medication

Prescribed frequency (times/day)	No of children	No of study days	Reported compliance in days (%) [*]	No (%) of days of recorded compliance	No (%) of days of recorded underuse	No (%) of days of recorded overuse
2	5	233	96	166 (71)	63 (27)	5 (2)
3	3	80	90	27 (34)	49 (61)	4 (5)
4	6	224	69	41 (18)	181 (81)	2 (1)

^{*}Expressed as a percentage of completed diary card days.

Results

Most subjects had no difficulty with the device as an inhaler holder. Indeed, two expressed a preference for the bulkier Nebulizer Chronolog. Satisfactory data were obtained in all 14 subjects from the Nebulizer Chronolog while diary card reporting was unsatisfactory in four.

Underuse was always found to be the omission of a time of administration rather than not taking enough puffs, whereas overuse consisted of taking more than the prescribed number of puffs. Overall, despite evidence of active asthma, underuse of prophylactic medication was recorded by the Nebulizer Chronolog on 55% of the study days (table). Perhaps surprisingly, overuse was only recorded in 2% of study days. Seven patients failed to take any prophylactic medication on at least one of the study days.

We found appreciable discrepancies between reported and recorded MDI use (table) with all children reporting better compliance than recorded, despite knowing that the device would 'count' the number of actuations. Also, although the numbers were small, we were interested to note differences in compliance with different frequencies of administration, with the five patients on a two times a day regimen being compliant on 71% of days compared with only 18% for those on a four times a day regimen.

Discussion

This pilot study demonstrates the feasibility of accurately monitoring long term inhaler use with an inhaler timer device.

One potential confounding factor with such devices is actuation without inhalation, as in the practice of 'test firing'. Only one subject, who had long periods of omitting to use his inhaler was noted to have numerous actuations (77 in 13 minutes) immediately before a clinic attendance. In practice, we considered that by actuating the device at an appropriate time the patient was probably inhaling it.

It has been reported that including children in prospective asthma trials may improve compliance rates, either because of a placebo effect or because of more consistent management.³ Despite this, the compliance rates we recorded were variable and often poor. The discrepancies noted between reported and recorded use highlighted again how poor diary cards are at capturing an accurate record of medication use.⁴

We were particularly interested in the changes in compliance with prescription frequency. Inspection of the printouts showed that, in those on a four times daily regimen, underuse usually resulted from missing out the middle doses. Only occasionally was medication not taken at all on any regular basis. The superiority of twice daily regimens was striking.

We conclude that an inhaler timer device provides a useful method for investigating compliance with inhaled medication in children. One important application of such devices may be in controlled drug trials where patients with poor compliance could easily be separated from those with poor treatment response.

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