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Providing information on metered dose inhaler technique: is multimedia as effective as print?

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Background. Metered dose inhalers (MDIs) are not easy to use well. Every MDI user receives a manufacturer's patient information leaflet (PIL). However, not everyone is able or willing to read written information. Multimedia offers an alternative method for teaching or reinforcing correct inhaler technique.

Objective. The aim of this study was to compare the effects of brief exposure to the same key information, given by PIL and multimedia touchscreen computer (MTS).

Methods. A single-blind randomized trial was conducted in 105 fluent English speakers (53% female; 93% White) aged 12–87 years in London general practices. All patients had had at least one repeat prescription for a bronchodilator MDI in the last 6 months. Inhaler technique was videotaped before and after viewing information from a PIL ($n = 48$) or MTS ($n = 57$). Key steps were rated blind using a checklist and videotape timings. The main outcome measures were a change in (i) global technique; (ii) co-ordination of inspiration and inhaler actuation; (iii) breathing-in time; and (iv) information acceptability.

Results. Initially, over a third of both groups had poor technique. After information, 44% (MTS) and 19% (PIL) were rated as improved. Co-ordination improved significantly after viewing information via MTS, but not after PIL. Breathing-in time increased significantly in both groups. Half the subjects said they had learned 'something new'. The MTS group were more likely to mention co-ordination and breathing.

Conclusions. Short-term, multimedia is as least as effective as a good leaflet, and may have advantages for steps involving movement. MTS was acceptable to all age groups. The method could be used more widely in primary care.

Keywords. Medicines information, metered dose inhalers, patient education.

Introduction

Metered dose inhalers (MDIs) are the first-choice device for most people with asthma, but they are not easy to use well.[1] Co-ordinating inspiration and firing the inhaler is a particular problem.[2]

Every MDI inhaler user receives a printed explanation of the key steps in correct use in the manufacturer's patient information leaflet (PIL), which by law must be included in every inhaler pack. The majority of PILs use both pictures and text. However, not everyone is able or willing to read written information.[3]

In this context, a multimedia information system incorporating video clips of an actual demonstration with voice-over instruction offers an attractive alternative option for teaching or reinforcing correct inhaler use, particularly for children, and other people who cannot read very well.[4]

Using multimedia to deliver health information has practical advantages: electronic information stored on CD, computer disk or on a Web page is easy to share across health care settings, and takes up much less shelf space than paper-based and videotaped methods.

Using multimedia may also be more effective than print-based information. The need for some active input from the recipient is claimed to make learning both easier and more enjoyable than with conventional methods.[5] A degree of choice can be offered as to how information is presented (e.g. language, age, gender, ethnicity). This could increase the acceptability and personal relevance of the information, and help inhaler users to feel more involved in their own health care.

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There is relatively little work on evaluating the effectiveness of different methods for improving MDI technique. Two studies[6,7] have concluded that written information is significantly less effective than advice from a health professional. However, the effectiveness of the print and multimedia formats has not been compared.[8]

The aim of this study was to compare the effects of brief exposure to standard information on correct inhaler use, given by PIL and by a multimedia program. The majority of patients who need a bronchodilator will start with, and remain on, a salbutamol MDI. For many of these people, the brand name Ventolin is synonymous with their 'reliever' inhaler. This study therefore used this PIL as a comparator information method.

The study was approved by the relevant Local Research Ethics Committees, and the Ethics Committee at King's College London.

Methods

This was a single-blind randomized controlled trial with two groups: multimedia touchscreen computer (MTS; Pharmacy Practice Group King's College London) and manufacturer's pack leaflet [PIL (Ventolin); Allen & Hanburys]. Patient allocation was done using random number tables, and was stratified by age (<25; 25–50; 50+). Patients did not know in advance which information method they would receive.

The MTS system consisted of an initial 'Welcome' screen in which the user chose their language by pressing a 'flag' icon. Pressing this activated the demonstration, which covered the key information points contained in pictures 1–6 of the 'How to use your inhaler' section of the Ventolin PIL (see Box 1). Key messages given in the voice-over were reinforced as on-screen text. After each step, the subject could chose whether to proceed, or to replay a section. At the end, they could chose to repeat a section, or the whole demonstration. This could be done as many times as they wished. The PIL used was a laminated copy of the 1996 version of the Ventolin pack leaflet. Both the MTS and PIL used white male models as demonstrators.

Box 1 *Information points checklist*

Take cover off and check the mouthpiece is clean
Shake the inhaler well
Hold the inhaler upright with thumb on the base, below the mouthpiece
Breathe out normally
Close lips firmly around the mouthpiece
Start to breathe in, then press down on top of the inhaler. Keep on breathing in steadily and deeply
Take inhaler from mouth
Hold breath for as long as is comfortable

Practice recruitment

Four London general practices (two single-handed; two large group) in North London were recruited via the Nocten primary care research network. Participating practices provided facilities and staff time, and were remunerated £25 per patient booked. The two small practices provided patients for piloting recruitment and assessment methods. One of these practices also contributed five patients to the main study.

Patient recruitment

Patients over 12 years old, recorded as using a bronchodilator MDI in the past 6 months were identified from surgery repeat medication records by the practice manager. Problem patients, and those known not to speak English well, were then excluded. A total of 487 people were mailed an invitation letter, plus a leaflet explaining that they would be asked to look at one of two types of information. Those wishing to participate returned a consent form to the practice, on which they specified suitable dates and times. These forms were then passed to the project manager (IS). Patients were given appointments during normal surgery hours, and could be referred on to either the practice nurse or their GP if required. A £10 gift voucher was offered as compensation for their time and travel costs.

Response in the 17–34 age group was much lower than predicted on the basis of practice data (Table 1). Recruitment was therefore extended to non-health science students at King's College London using the college e-mail system. This produced a further nine volunteers.

Study procedure

Each patient had a 30 min appointment. First, the study was explained, and patients (or their guardians) gave written consent for a videotape to be made. One patient refused consent for anyone other than the project manager to view the video; another only consented after seeing the first video. Demographic and asthma medication details were then elicited.

Next, the patient was asked to demonstrate how they used their inhaler. Technique was assessed without a spacer, using a placebo MDI canister inserted into the patient's own reliever holder. A video camera with playback facility mounted on a tripod was used to record the demonstration.

Patients were then presented with the computer (MTS) or the Ventolin pack leaflet (PIL). They were asked to look through the information on their own first, and then to tell the investigator what they thought about it. The inhaler demonstration was then repeated. Remaining technique errors were discussed and documented, and patients referred on to the practice nurse or GP if required.

TABLE 1 *Response rates by age group*

Age band	12–16	17–24	25–34	35–44	45–54	55–64	65–74	75 plus	Total
Total eligible	39	41	94	88	78	68	48	43	499[a]
Total participated	8	1	3	13	16	21	12	16	90
% eligible subjects	20.5	2.4	3.2	14.8	20.5	30.9	25	37.2	18

[a] Number eligible on initial computer search. Twelve further exclusions were made by practice staff. Final number of patients mailed = 487.

After the session, the researcher escorted them to the surgery exit, then called the next subject in. This minimized the chance of outgoing and incoming subjects exchanging information about the study in the surgery waiting room.

Assessment of inhaler technique

Videotaped demonstrations were digitized, compressed to MPEG format and transferred to CD-ROM. They were subsequently assessed 'blind' by an assessor (LG) who did not attend experimental sessions and had no contact with patient volunteers. Global technique was rated as poor, adequate or good. The individual steps shown in Box 1 were scored as correct/incorrect using a checklist. Inhaler shaking (counts) and length of inspiration (seconds) were assessed directly from the videotape recordings.

It was often difficult to determine an accurate start time for breath holding. Instead, the variable 'breathing in' was defined as the time interval between starting to breathe in and exhaling. Co-ordination failure was defined as pressing the canister before inspiration.

Pre- and post-information technique ratings were repeated in a purposive sample of 12 patients, chosen to illustrate the range of good and poor technique. There was good agreement between the two data sets (global technique chi-square, df 4 $P < 0.002$; co-ordination kappa, 0.795 $P < 0.0001$).

Information acceptability and usefulness

This was assessed from responses (agree, neutral, disagree) to a series of 18 statements about the information format and content. Patient verbatim comments were also recorded, and some demographic information, including their use of computers and the Internet, was also collected.

Statistical analysis

The Statistical Package for the Social Sciences (SPSS) was used to analyse data. Chi-square test (categorical variables) and independent *t*-tests (continuous normally distributed variables) were used to compare baseline data in the two information groups. McNemar's test and paired *t*-test were used for within-group changes.

Based on previous (unpublished) work in which inhaler technique was assessed before and after verbal information, it was estimated[9] that 30 patients per group would give 80% power to detect (at $P < 0.05$) a halving of the 'fail rate' for adequate breath holding after information.

Results

Approximately a quarter of all GP patients mailed responded to our invitation. All were interested in taking part, but not everyone could be given appointments at times to suit them. Some 114 appointments were booked; four people either cancelled or failed to attend.

To maintain patient confidentiality, the project manager did not have access to the initial patient database, so it was not possible to compare the characteristics of responders and non-responders. However, practice EMIS data (Table 1) suggest a positive relationship between age and response rate in adults, with over a third of all eligible over 75s taking part. The timing of the research sessions, their perceived relevance and the size of the reward offered are all possible factors.

Overall, the £10 gift voucher was not a strong incentive. One in five participants declined it, saying the money should go to asthma research.

A total of 110 inhaler users were randomized and reviewed. All were fluent English-speakers; only 10 did not have English as their first language. A third were currently employed. Over half had used a computer in the past year. Five were excluded from analysis because they could not use their MDI without a spacer (four) or were not now using an MDI (one). The final sample comprised 105 'experienced' inhaler users aged between 12 and 87 years old who had used inhalers on average for 13 years (range 3 months to 50 years). Thirty-nine (40%) used a large-volume spacer for some or all of their doses. Eighteen (17%) used 'as required' bronchodilators only; 41 (36%) used prn relief plus regular low-dose steroids.

Fifty-seven patients received multimedia information (MTS) and 48 received the leaflet (PIL) ($n = 48$). The time interval between the first and second inhaler demonstrations was not significantly different in the two information groups (MTS 21.7 ± 10.7 min; PIL 18 ± 10.8 min). The two groups were well matched for all demographic and disease variables (see Table 2).

Useable videotape data were available for 100 patients (55 MTS; 45 PIL). The blind assessor was unable to decide

TABLE 2 *Subject details*

	Multimedia $n = 57$	Leaflet group $n = 48$
Age group		
<25	10 (17.5%)	7 (14.6%)
25–50	14 (24.6%)	14 (29.2%)
50+	33 (57.9%)	27 (56.3%)
Demography		
English first language	52 (91%)	43 (90%)
White	55 (96%)	42 (89%)
Female	30 (53%)	26 (54%)
Work full or part time	19 (33%)	17 (35%)
Used computer in past year	34 (62%)	27 (56%)
Total inhaler use (years)		
Mean (SD)	13.4 (11.3)	13.8 (11.9)
BTS treatment step[a]		
1	10 (18%)	8 (17%)
2	20 (35%)	21 (44%)
3+	25 (44%)	18 (38%)
Large volume spacer		
Uses for some/all doses	23 (40%)	16 (33%)

[a]British Thoracic Society Step 1: occasional relief bronchodilators; Step 2: regular inhaled preventer therapy; Step 3: high-dose inhaled corticosteroids or standard-dose inhaled corticosteroids + long-acting inhaled beta2 agonist; Step 4: high-dose inhaled corticosteroids + regular bronchodilators; Step 5: regular corticosteroid tablets.

on a global rating in two cases (one from each group), and a few of the videos were insufficiently clear to allow all steps to be rated.

The proportions of subjects performing key steps correctly before information were not significantly different between groups, or between age groups. At least a third of patients in both groups were rated as having poor technique (Table 3) and over two-thirds had poor co-ordination (Table 4).

Changes in inhaler technique

After viewing information, 23 (44%) of the multimedia group and eight (19%) of the leaflet group were rated as having better technique (Table 3). The changes in the MTS group were statistically significant. From comments made on rating forms, the assessor defined good technique primarily in terms of co-ordination. Global change in technique was highly correlated with co-ordination, but not with changes in breath holding.

Patients in both information groups showed small but statistically significant increases in breathing-in time (Table 5). Changes were larger in the MTS group, and the proportion of subjects passing the 10 s cut-off point for breathing-in time doubled (Table 4), validating our sample size calculation.

Co-ordination (Table 4) improved significantly after viewing MTS information, but not after viewing the PIL.

TABLE 3 *Global technique ratings*

	Multimedia $n = 52$				Leaflet group $n = 43$			
Technique before information	Poor	Adequate	Good	Total	Poor	Adequate	Good	Total
Initial number	21	24	7	52	15	24	4	43
% total	40%	46%	14%	100%	35%	56%	9%	100%
Technique after information								
Better	11	9	3	23	4	3	1	8
(% initial number)	(52%)	(38%)	(43%)	(44%)	(27%)	(12.5%)	(25%)	(19%)
Same	9	14	4	27	10	19	2	31
Worse	1	1	–	2	1	2	1	4

TABLE 4 *Categorical technique variables (paired data: McNemar's test)*

Technique measure	Multimedia group				Leaflet group			
	n	Before information	After information	*P*-value	*n*	Before information	After information	*P*-value
Checks mouthpiece (*n* correct)	55	3 (5%)	10 (18%)	NS	45	1 (2%)	3 (7%)	NS
Shakes inhaler (*n* correct)	55	30 (55%)	41 (75%)	0.02	45	29 (64%)	32 (71%)	NS
Co-ordination (*n* correct)	51	17 (33%)	28 (55%)	0.001	44	11 (25%)	12 (27%)	NS
Breathing in ($n \geqslant 10$ s)	51	13 (25%)	27 (53%)	0.01	41	12 (29%)	18 (44%)	NS

TABLE 5 *Continuous technique variables (paired data; paired* t*-test)*

Technique measure	Multimedia group					Leaflet group				
	n	Before information	After information	Difference (95% CI)	*P*-value	*n*	Before information	After information	Difference (95% CI)	*P*-value
Inhaler shaking (n times)	53	3.9	5.6	+1.7 (0–3.4)	0.05	42	5.7	5.8	+0.1 (–1.6 to 1.7)	NS
Breathing-in time (s)	51	7.7	9.8	+2.2 (0.9–3.4)	0.001	41	8.1	9.6	+1.6 (–0.1 to 3)	0.03

Over half of users in both groups shook the inhaler at baseline. After viewing MTS information, both the occurrence and frequency of shaking increased significantly. Very few people in either group checked the inhaler mouthpiece before use. Changes after information were not statistically significant in either group.

Acceptability of information method

There were clear differences in the extent to which subjects engaged with the information method. With the PIL, many did not look at the pictures and text describing inhaler use until prompted by the investigator, and a proportion were clearly not concentrating on what they saw. With the MTS system, user attention was engaged immediately, and some made spontaneous comments as they worked through the screens.

Using the touchscreen system was easy, with few people of any age requiring even minimal prompting.

The full results of the questionnaire will be reported elsewhere. The multimedia method was at least as acceptable as the leaflet, and participants rated it significantly less boring ($P < 0.01$). Previous experience with computers made no difference to subjects' views.

Half of all patients in both groups said they had learned something new from the information (Table 6). The multimedia group were more likely to mention co-ordination and breathing, while the leaflet group were more likely to mention cleaning and checking the device. Combined with the changes observed on video demonstrations, this suggests that moving pictures have an advantage over stills when it comes to teaching the most important steps in good inhaler technique.

However, acquiring new information on co-ordination only translated into improved technique in a third of cases. The comments that some of these experienced inhaler users made suggest that the 'new information' they had acquired was not necessarily seen as personally relevant.

TABLE 6 *New information learned in session: number of patients mentioning topic*

Topic area	MTS	PIL
Breathing/co-ordination	17	3
Shaking inhaler	7	2
Checking/cleaning device	6	16
Posture/holding device	11	5
Other	0	7
Total patients commenting	34	21

Onward referral

Forty patients were referred to the practice asthma nurse. A third clearly still had poor technique, but over half also had other concerns. The remainder had medication- or symptom-related problems, or simply wanted the reassurance of a nurse review. There was no difference in referral rates between groups.

Discussion

To date, studies that have attempted to assess inhaler technique have tended to use direct observation. The obvious disadvantage in this is the difficulty of blinding when trying to assess any benefits of patient education. We could find only one previous study[10] which has attempted to control for observer bias in ratings. Our study attempted to do this by filming patients using their inhalers and then digitizing the films and transferring clips to a CD for blind assessment.

Around a third of inhaler users were judged as 'poor' on global assessment, and at least two-thirds had poor co-ordination. These proportions are in line with other studies, in which important manoeuvres have been reported correct in 30–65% of cases. Fewer than one in five users were judged to have 'excellent' technique. This agrees with previous work in English general practice.[11]

We have shown that brief exposure to information alone, with no input from a health professional, can produce changes in global inhaler technique ratings in around a third of people. There were differences between the two information-giving methods in terms of engaging attention, and in the observed changes in specific aspects of technique.

We had hypothesized that patients would learn better through multimedia, and that a smaller number would need onward referral, thus saving staff time. However, this did not prove to be the case. Both the PIL and the MTS were effective in imparting 'new information', but this did not necessarily translate into changed technique. There are many possible reasons for this, but the perceived authority of the source and the personal relevance to the user may be factors.

Graham *et al.*[12] concluded that multimedia had no advantages over well designed leaflets when used to give pregnant women information on the purpose of prenatal tests. However, these authors noted that the method did seem to reduce anxiety levels, and that uptake of certain types of scan was higher in the intervention group. So the multimedia method did change what some women did.

We suggest that our findings in this much smaller trial are similar. The multimedia method of providing people with information on correct inhaler technique was at least as good as a good leaflet, and may have advantages when it comes to showing movement. However, both information methods only produced change in a proportion of people.

Our English-speaking predominantly White sample contained a good mix of socio-economic groups, but the age distribution was heavily skewed towards the over 50s. They were long-term MDI users, with deeply ingrained habits. Brief exposure to information did change their awareness of key technique points, but this did not always translate into changed behaviour. Greater benefits might be expected in new inhaler users.

Using multimedia to provide patient information has practical advantages. Unlike paper leaflets, the information takes up little space and is easy to share. The technology required is well established and relatively low cost. In contrast to our expectations, older people had no difficulty in accessing information via multimedia and appeared to enjoy it. We suggest the method could be used more widely in primary care.

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