Effectiveness Of Specialist Nurse Teaching : A Patient Education Study To Enhance Inhaler Techniques.

A report prepared for the North East Thames Regional Health Authority as part of the Stimulating Progress Fund scheme

The enclosed report summarises the methods, results and conclusions of a nursing research study in Waltham Forest Health Authority (January-May 1989) supervised by the department of Nursing Studies, King's College London (KQC).

Kevin P. Corbett
October 1990.

Introduction

This exploratory study compared the effectiveness of three patient education interventions upon the metered-dose inhaler (MDI) technique of patients on general medical wards.

The interventions consisted of :

1) Sessions of "skill" practice.
2) Video demonstrations.
3) Use of explanatory literature.

The research generated a data base valuable for prospective respiratory health workers, similar to previous studies (Bagnall and Heslop 1988); and for evaluation of current patient education strategies.

Background to study

Metered-dose aerosol inhalers (MDIs) are one of the most popular self-administration devices for adult respiratory patients (Kallos et al 1959; Harper and Strunk 1981; and Tobin et al 1982).
MDIs offer a rapid onset of action (Plitt et al 1972) and a low incidence of side effects (Graeser and Rowe 1935; and Sterling 1978).

Justification and Rationale

Several studies have repeatedly shown that patients are unable to use MDIs correctly (Paterson and Crompton 1976; Gayrard and Orehek 1980; Gayrard et al 1976; Earis and Berstein 1978; Epstein et al 1979; and Banias and Hurley 1986).

Poor technique has also been observed in as many as eighty-nine percent of out-patient department attenders (Ellis and Friend 1985).

Studies show that health care workers are unable to properly demonstrate correct MDI technique i.e. physicians (Kelling et al 1983: Frew and Macfarlane 1984); nurses and doctors (Burton 1984); nurses (Henney and Blatt 1984); and pharmacists (Rogers 1984).

Poor patient education has been cited as one of the major factors contributing to poor MDI technique amongst general hospital out-patient attenders (Ellis and Friend 1985).

Literature review

A review of the relevant patient education studies with respiratory patients showed nine studies where significant improvement in MDI technique were demonstrated (Corbett 1989).

All studies reviewed, featured quasi-experimental or experimental designs. No study followed subjects from acute admission to discharge. Six studies were completed in hospital out-patient departments. Only one study was located within a hospital ward setting (Roberts et al 1982).

Several teaching interventions appear comparable: Video and Audio-Visual: Mulloy et al (1987) and Darr et al (1981); Structured Education programmes involving nurse instruction (NI): Heringa et al (1987) or Pharmacist Counselling (PC): and O'Bey et al (1982) De Tullio et al (1987), Self et al (1983), Rogers (1984), and Roberts et al (1982);.

Video instruction appears not to enhance the effects of personal demonstration. However, used on its own, video is more effective as an intervention than receipt of a manufacturers' written leaflet (MWL) (Self et al 1982).

Studies featuring pharmacists or nurses as teachers showed improvements in MDI technique: in subjects' lung function (FEV1) and in the mean number of performance actions which non-counselled subjects omitted (DeTullio et al 1987); and in performance of those counselled, compared to the other groups (non-counselled or leaflet only) (Roberts et al 1982; Self et al 1983).

Teaching by a nurse or pharmacist is therefore the most effective intervention to improve subjects performance of MDI technique (Heringa et al 1987; O'Bey et al 1982) and and their lung function (DeTullio et al 1987).

Regular instruction of the technique is needed because subjects' performance decayed with time (O'Bey et al 1982). The potential of nurse practice sessions to improve a closed mouth MDI technique is demonstrated by the reviewed studies: (DeTullio et al 1987, Roberts et al 1982, Self et al 1982, Heringa et al 1987, and O'Bey et al 1982).

The role of skill acquisition in development of closed-mouth MDI technique remains poorly defined (O'Bey et al 1982; Heringa et al 1987).

Further exploratory studies are called for with a more thorough review of the relevant literature.

Research design and methodology

Design

The study design was experimental employing repeated measures. Subjects acted as their own controls. Groups were sequentially recruited. The design measured the effectiveness of the teaching interventions. The time frame complemented those of previous studies (Roberts et al 1982; Heringa et al 1987).

Sample size and setting

A convenience sample was sought of approximately thirty patients using MDIs. With ethical approval of Waltham Forest Health Authority, consenting subjects were approached in the wards at Whipps Cross Hospital.

Interventions

All teaching interventions were completed within the ward areas.

The interventions were: the manufacturer's written leaflet (MWL) demonstration, video instruction of a closed mouth MDI technique (VI) , and nurse practice sessions (NP). VI was based on a previous literature review detailing correct MDI technique (Newman et al 1981).

A closed mouth technique was demonstrated by the nurse researcher from the most detailed of the manufacturer's written leaflets (Ventolin - Allen & Hanburys Limited).

Fourteen pharmaceutical company videotapes were screened and selected for high content validity forming a three and a half minute sequence.

Nurse practice sessions with optional feedback employed spirometric measures of lung function (vital capacity) with a placebo MDI attached to the aerosol inhalation machine (AIM - Vitalograph, UK Ltd.).

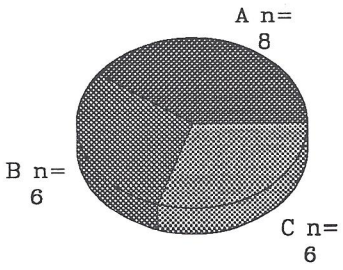
Instruments and measures.

Five measures of MDI technique were developed using direct and indirect methods of performing the closed-mouth MDI technique.

Using direct observation :

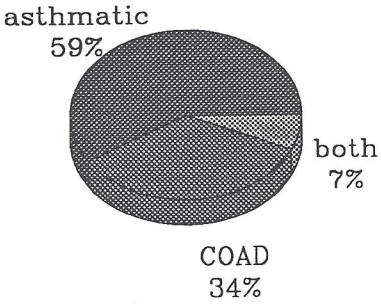
1) an observer rating scale (ORS)
2) spirometric AIM measures (firing, drug delivery and breath-holding). Visual feedback using AIM of subjects performance (knowledge of results) was optional, depending upon which group subjects were recruited to.

Composition of Groups



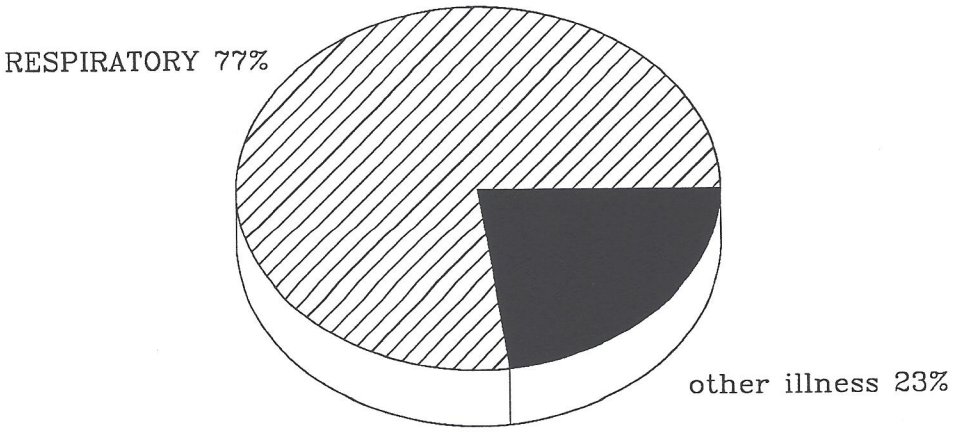
MAIN STUDY

Respiratory diagnoses



percentage of sample

Diagnoses of sample



PERCENTAGE of SAMPLE

Several previous studies have measured MDI technique with different modes of feedback for the subject eg. acoustic (McGavin 1976); and visual feedback (Lee and Evans 1987).

Using indirect measures of MDI technique :

3) spirometric measurement of lung function (FEV1). A Vitalograph alpha spirometer (Vitalograph 1987) measured the forced expiratory volume in one second (FEV1) for each subject. A standardised forced vital capacity test (FVC) was taught to every subject.

4) a knowledge test (KT) using similar multiple choice questions for all possible proprietary inhaled drugs likely to be prescribed.
5) a self-rating scale of MDI technique performance (0 - 5 : very bad to very good).

Literature previously seen with regard to MDI demonstration and instruction were also recorded as part of a semi-structured baseline interview .

Data collection and analysis

Data analysis proceeded by calculation of performance percentages for groups on 4 occasions using the five measures above.

1) Before teaching: pretest (PreT).
2) After teaching : post-test one (PT1).
3) " " post-test two (PT2).
4) " " post-test three (PT3).

Three measures (ORS; AIM and FEV1 via FVC test) were repeated on four occasions (PreT, PT1, PT2 and PT3); knowledge about MDI use was tested before and after teaching (PreT, PT3) and the self-rating scale assessed ability to use a MDI before teaching (PreT). FEV1 was not measured at PT1.

The FVC test indirectly measured subjects' native technique (PreT); the remainder, indirectly, measured taught technique (PT2 and PT3).

Change between tests to assess the effect of the interventions was calculated by subtraction of percentages: (PT1-PreT), (PT2-PT1), (PT3-PT2). Averages across all tests formed a measure of overall MDI technique performance by group for both AIM and ORS.

Statistical significance was calculated by non-parametric methods as the data was not normally distributed. The Kruskal-Wallis one-way analysis of variance corrected for ties (Siegel and Castellan 1989) was applied to the data. This enabled to determine if all three groups experienced the same average change. P value was set at 0.05.

Pilot study

A short study piloted the technique demonstration (n=6); ORS (n=9); AIM test (n=5); the FVC test (n=10); the multiple choice KTs (n=10) and the self-rating scale (n=10).

Results of main study

Sample

Twenty-nine subjects (15 men and 14 women) were consented into the study at pretest (n=29); with twenty subjects (11 men and 9 women) at post-test three (n=20). Sample size reduced during the study by 28.6%.

77% of the sample were currently admitted suffering with chest diagnoses: 59% (n=17) had asthma ; 34% (n=10) had chronic obstructive airways disease ; and 7% (n=2) had both diagnoses.

Baseline assessment

Information about the correct MDI technique was received by 67% of the sample from written sources; from verbal sources by 22% and 11% did not specify a source.

52% of the sample reported never having received either a check, or a demonstration of the correct technique prior to the study.

86% (n=25) reported reading the leaflet provided with their inhaler; 14% (n=4) reported not reading it. 14% of the sample (n=4) reported never having read the leaflet; 35% (n=10) within the previous six weeks ; 21% (n=6) in the previous twelve months ; and 17% (n=5) in the previous six years .

Only 7% (n=2) reported reading the leaflet with every new inhaler .

Group A self-reported as most able to correctly perform MDI technique (3.58); followed by C (3.38); and the poorest B (2.89).

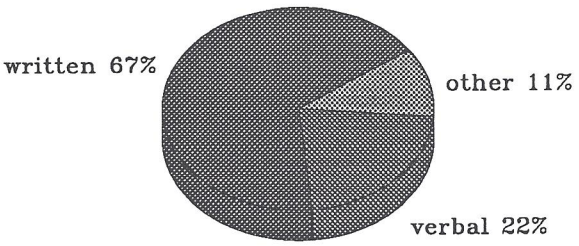
Group A scored best on knowledge (KT) of order of inhaling and actuation (71.4%); on order of actions after firing the inhaler (35.7%); and for time interval between separate inhalations (50%). Only fourteen subjects completed KT at both pre and post-tests (PT3).

Observer rating scale (ORS)

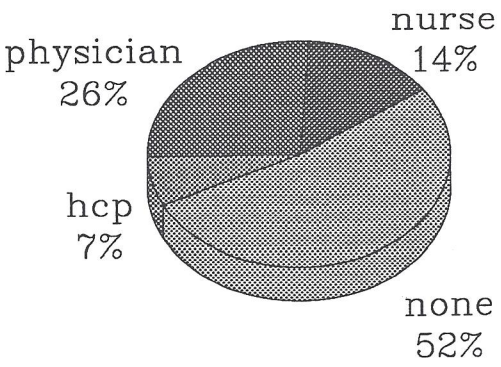
Group C experienced poorer technique at PreT (8.25 ± 1.9) compared to A (8.91 ± 1.8) or B (9.33 ± 2.1), but the highest at PT1, PT2 and PT3. Group C had the highest observed score (ORS) at PT1, three times that of group A and group B.

baseline assessment

a) nature of information previously received

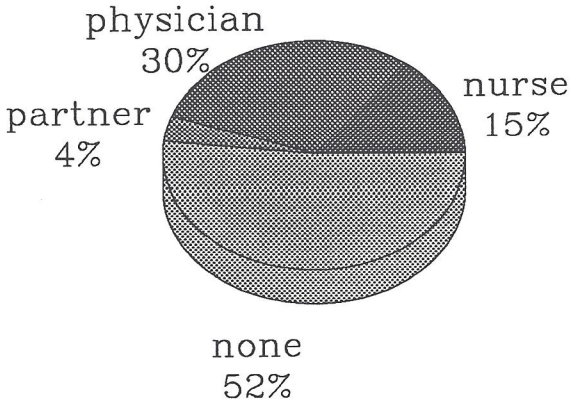


b) technique checked by professional

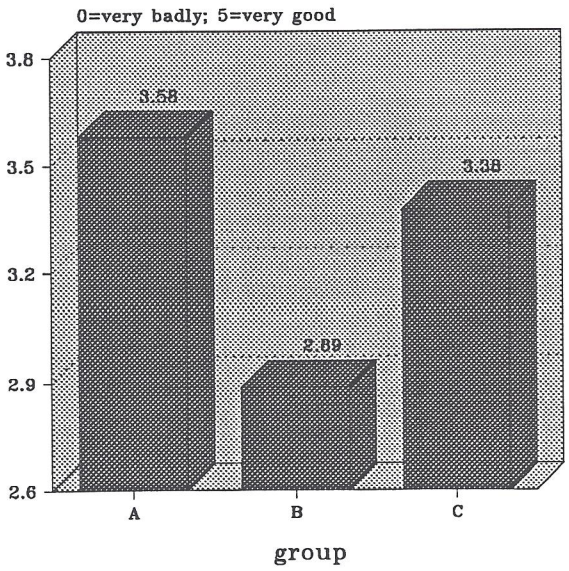


hcp= unspecified health care professional

c) demonstration of technique by profession



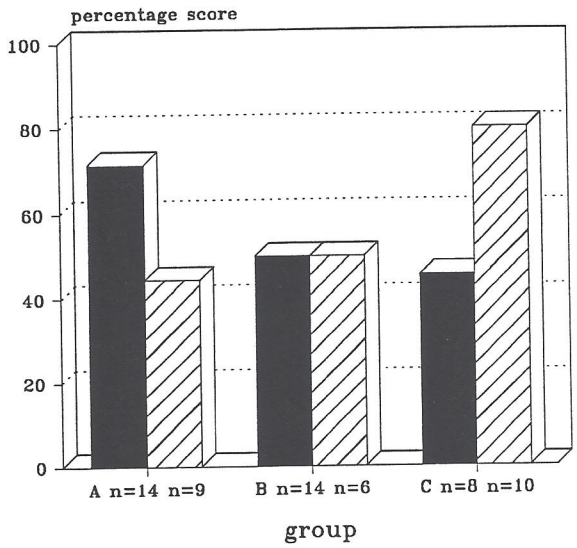
d) self-rating scale: group baseline MDI* technique (before teaching)



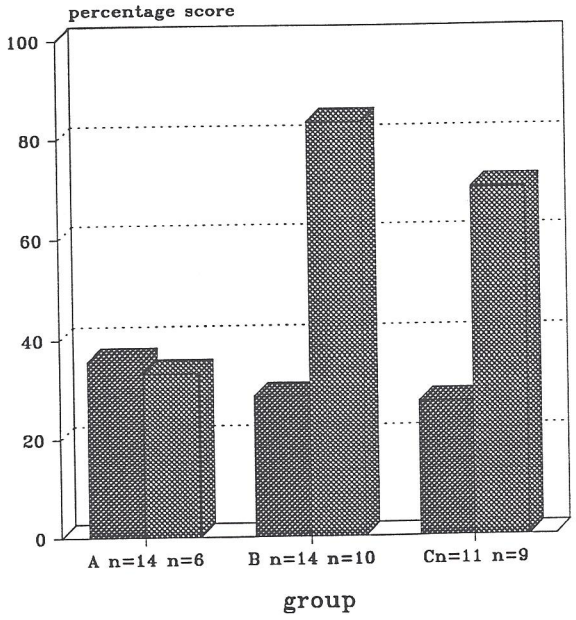
*MDI= metered dose inhaler

Knowledge Test:

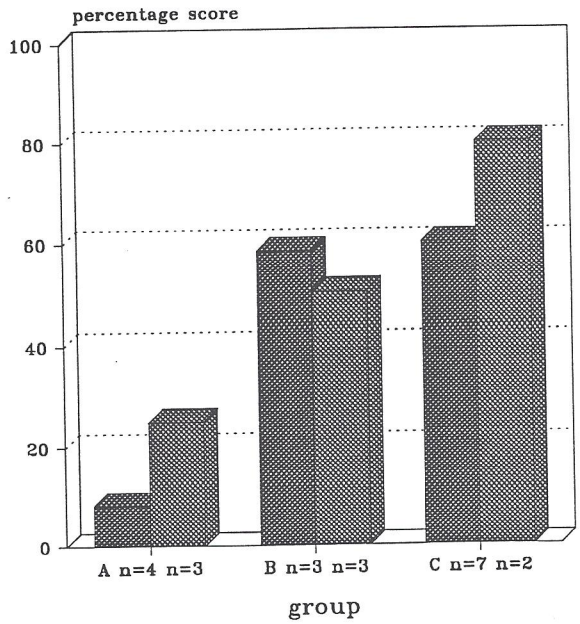
a) order of inspiration and actuation



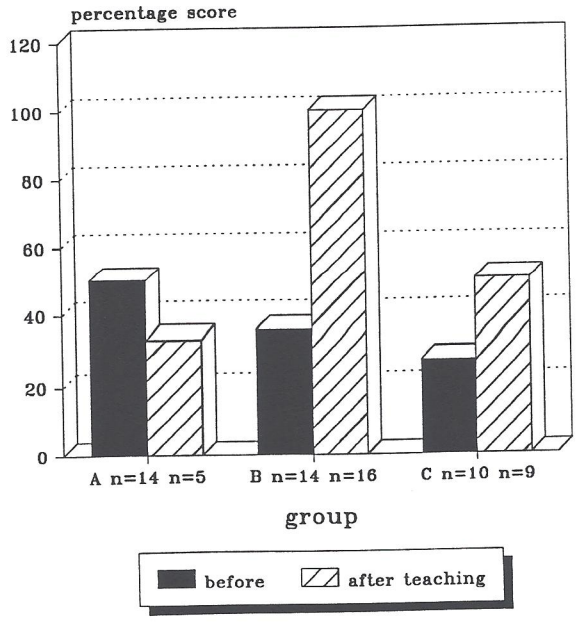
b) order of actions after inhalation



c) recommended practice regime

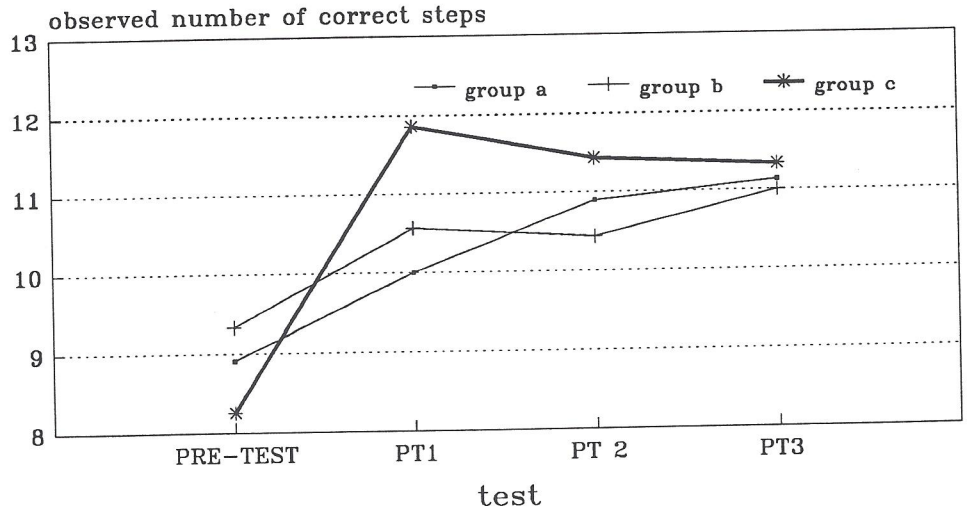


d) time interval between puffs



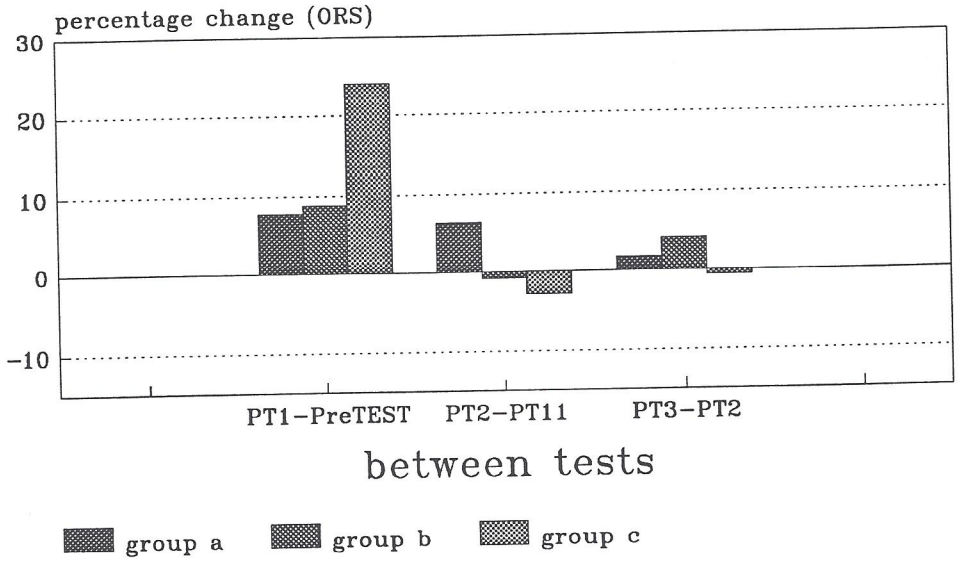
Results of ORS*

a) observer scores across tests



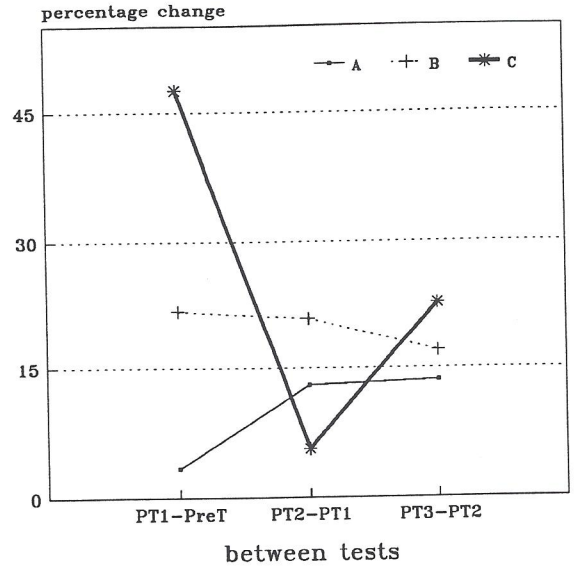
(* = observer rating scale 0-13 steps)
pretest-PT1: change significant $p<0.05$
(Kruskal-Wallis) at PT1 all groups

b) change between tests

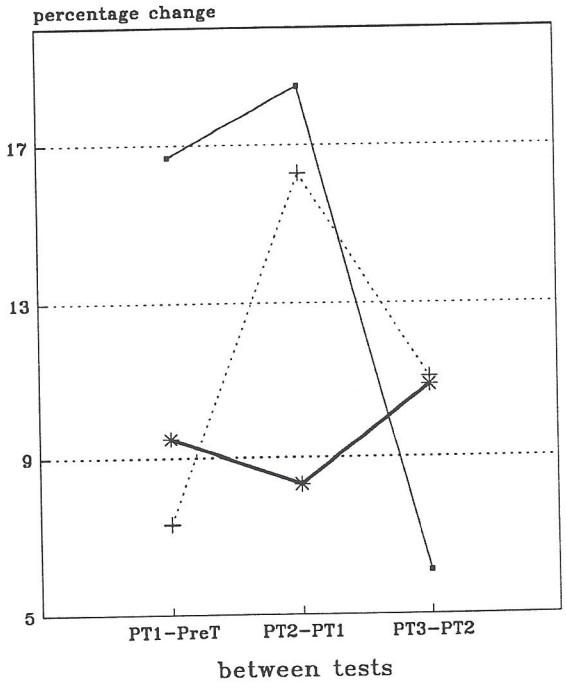


(* = observer rating scale 0-13 steps)
pretest-PT1: $p<0.05$ KW anova)

ORS* results analysis of trends in steps 6 to 11.

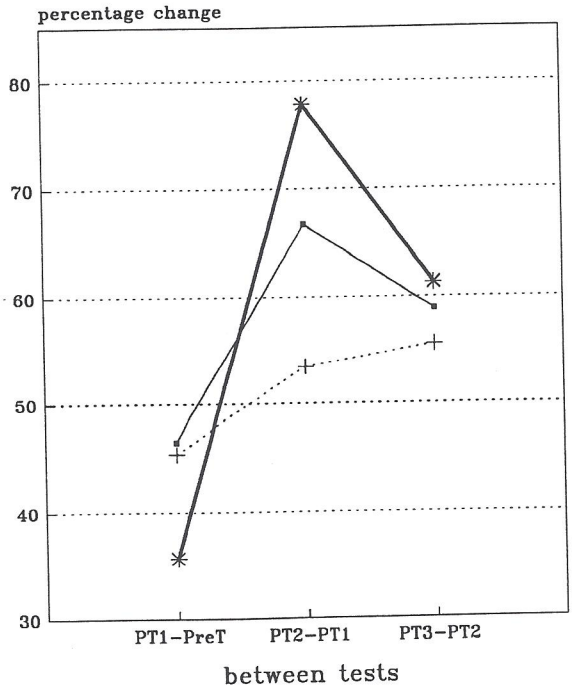


% improving technique

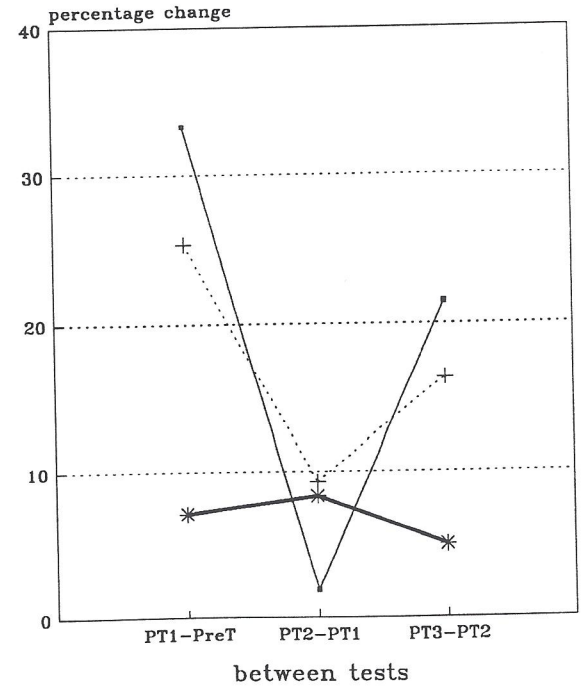


% decaying technique

*= observer rating scale.



% staying good



% staying poor

Change in observed performance was significant (Kruskal-Wallis p=0.05 and p=0.02) between native and taught technique (PT1-PreT). Group C experienced greater change compared to groups A or B.

Crucial stages of the MDI technique, as measured by ORS (steps 6-11) were examined in four performance trends: two static trends (staying good or staying poor), decaying and improving. Steps 6-11 of ORS were successful completion of the following:

6. Breathe in slowly and deeply through mouth.
7. Press inhaler firmly while continuing to breath in slowly and deeply.
8. Hold breath for ten seconds or as long as is possible.
9. Breath out slowly.
10. Use one inhalation ("puff") at a time.
11. Wait at least one minute between "puffs".

Group C experienced a greater percentage static change in the technique staying good (61.3%); lowest change in technique staying poor (7%) ; and experienced greater initial (PT1-PreT) improvement in technique (47.6%).

Aerosol inhalation machine (AIM) measurement of MDI technique

Percentage scores showed group C experienced greatest performance across all tests. After teaching (PT1-PreT), group C has the greatest percentage performance change for drug delivery and for technique, than groups A or B. All AIM results are not statistically significant, except for group C breath-holding after teaching (PT1-PT2).

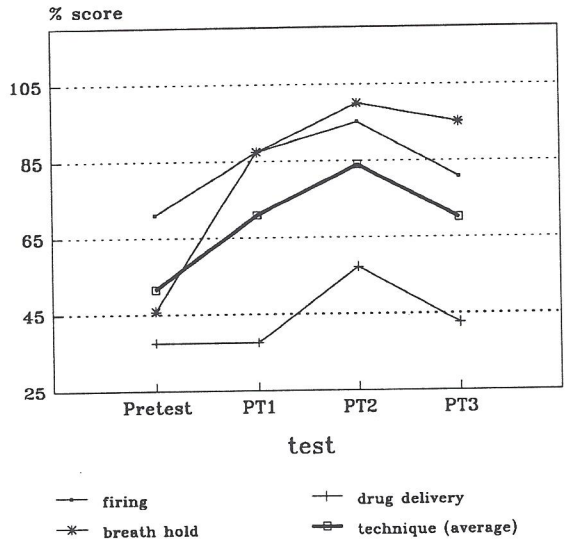
Spirometric measurement (FEV1) of lung function via a forced vital capacity test (FVC)

All groups FEV1 results after teaching were greater than before. Group C experienced highest FEV1 results pre- and post-test, but group A experienced the greater percentage change after teaching (non-significant - Kruskall-Wallis One Way ANOVA).

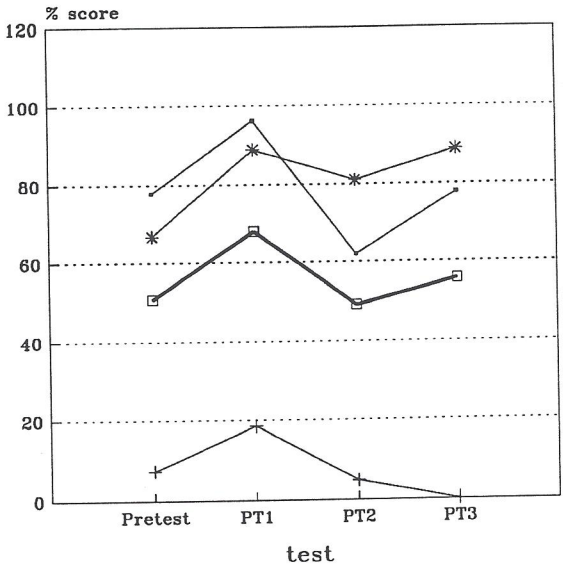
Further analysis of a "true" bronchodilatory response (15-25% increase in FEV1 over baseline-DeTullio et al 1987) showed a smaller number of subjects per group with improving FEV1 between tests.

Kruskal-Wallis One-Way ANOVA applied to change between tests showed non-significant changes for all groups between tests, though group B has highest mean of the ranks for native technique, similarly group A at PT2 and group C at PT3.

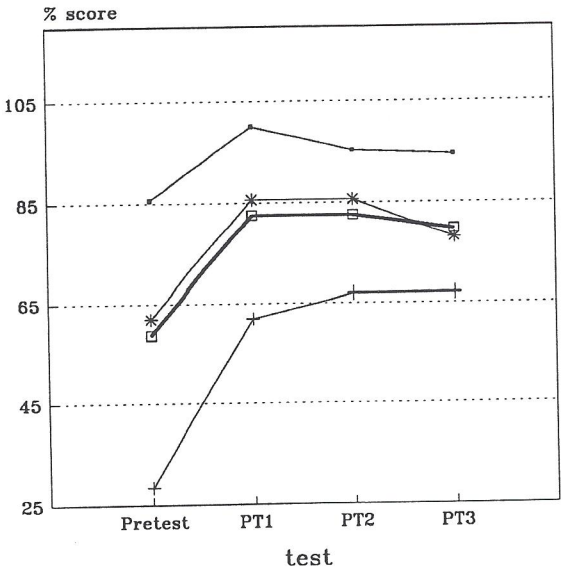
AIM* percentage and average percentage score: group A



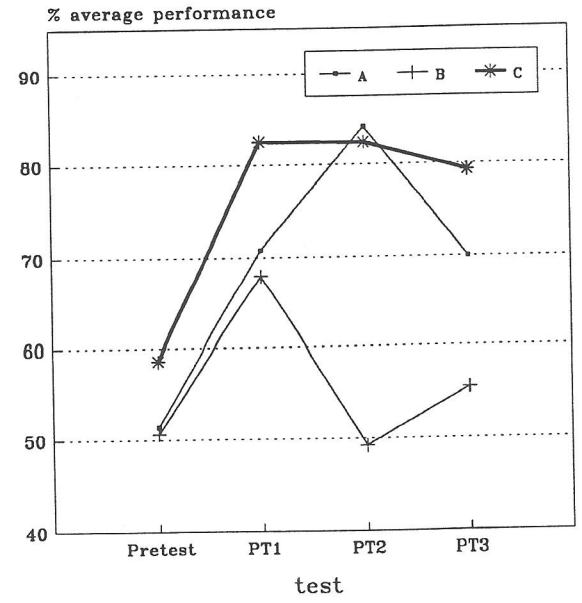
group B



group C

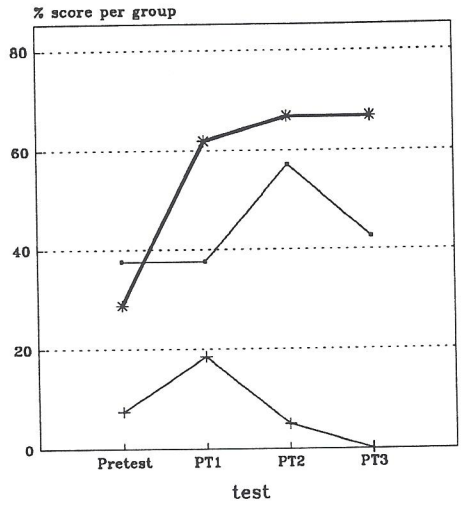


Average performance of technique* by group

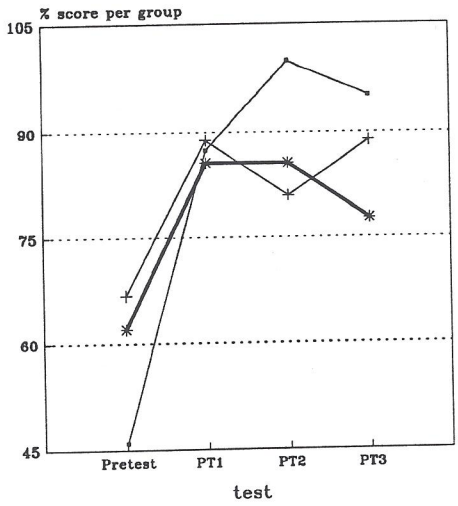


*= average of firing, drug delivery and breath holding.

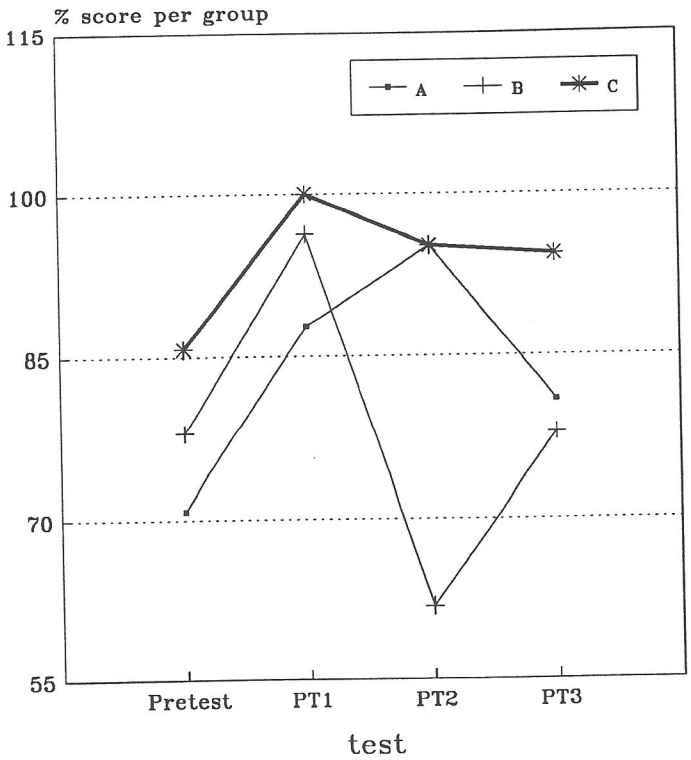
DRUG DELIVERY



BREATH HOLD

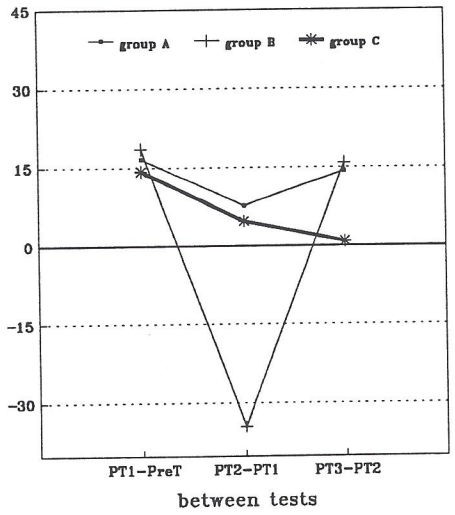


AIM* performance across tests: FIRING

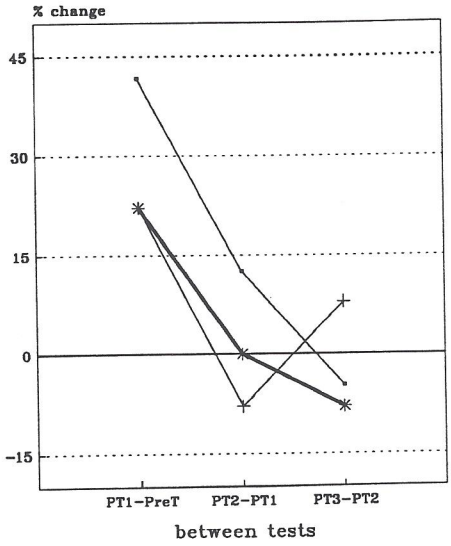


*=aerosol inhalation machine

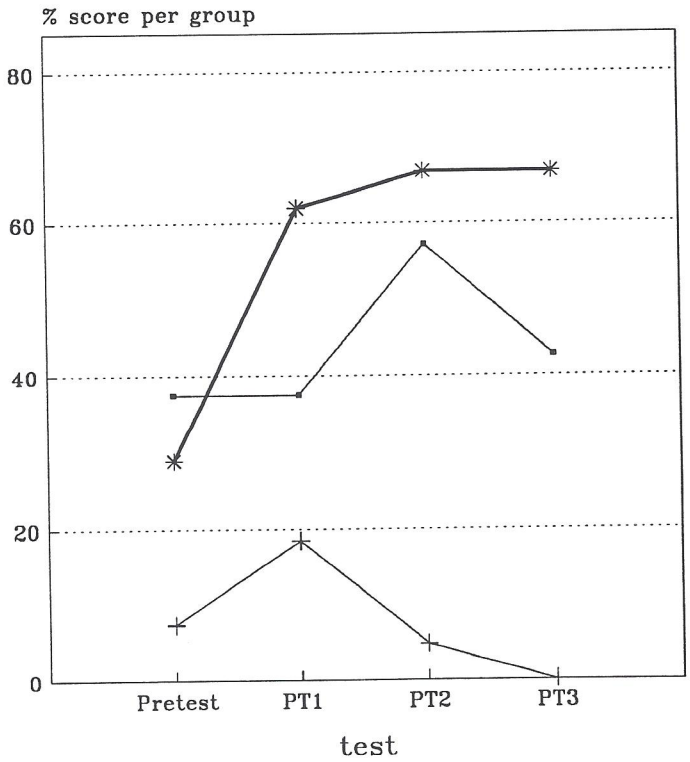
AIM percentage change
after teaching: FIRING



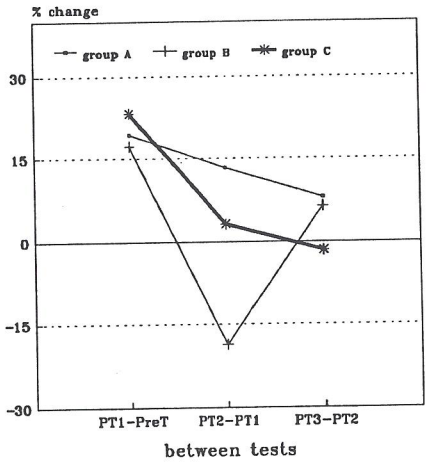
Breath Holding



DRUG DELIVERY

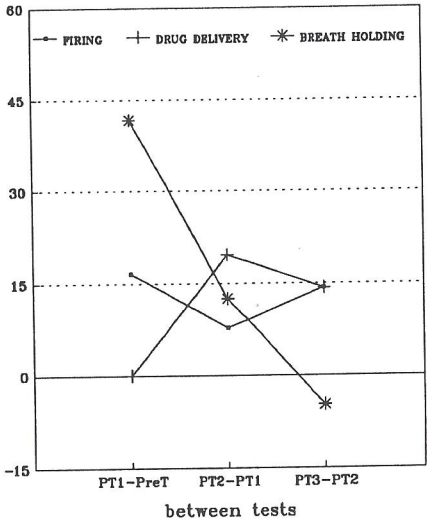


PERCENTAGE CHANGE IN AIM CRITERIA AFTER TEACHING:

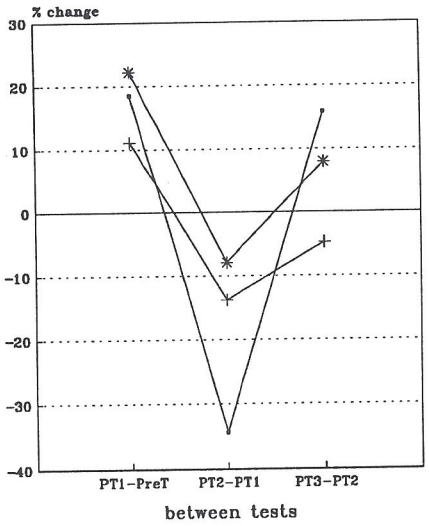


all groups

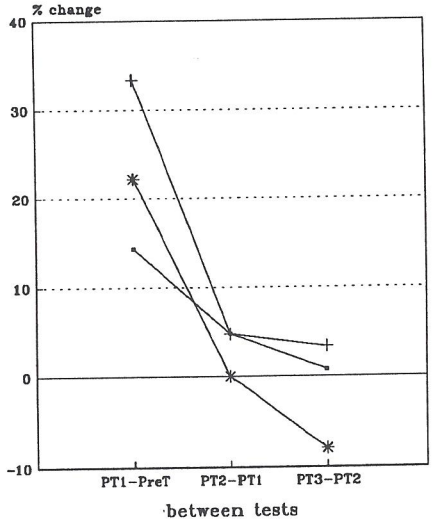
group A



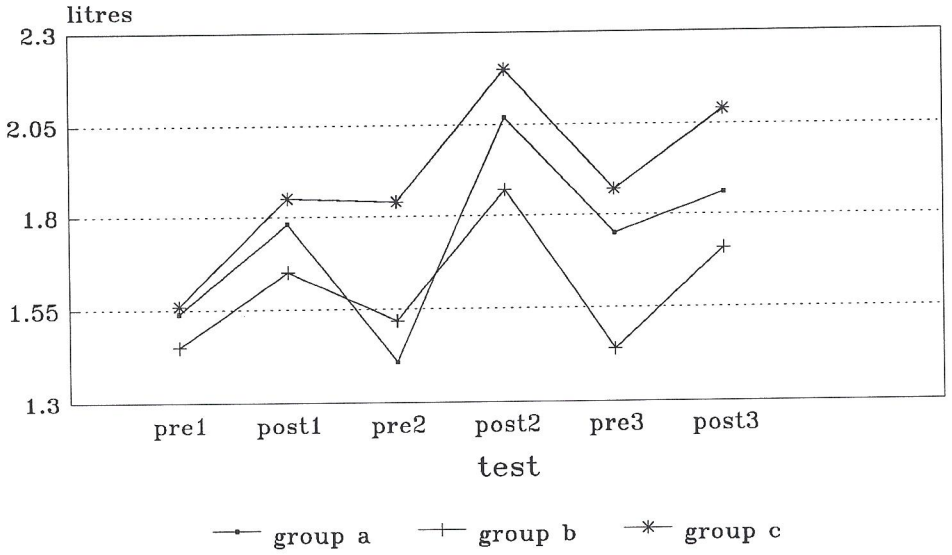
group B



group C

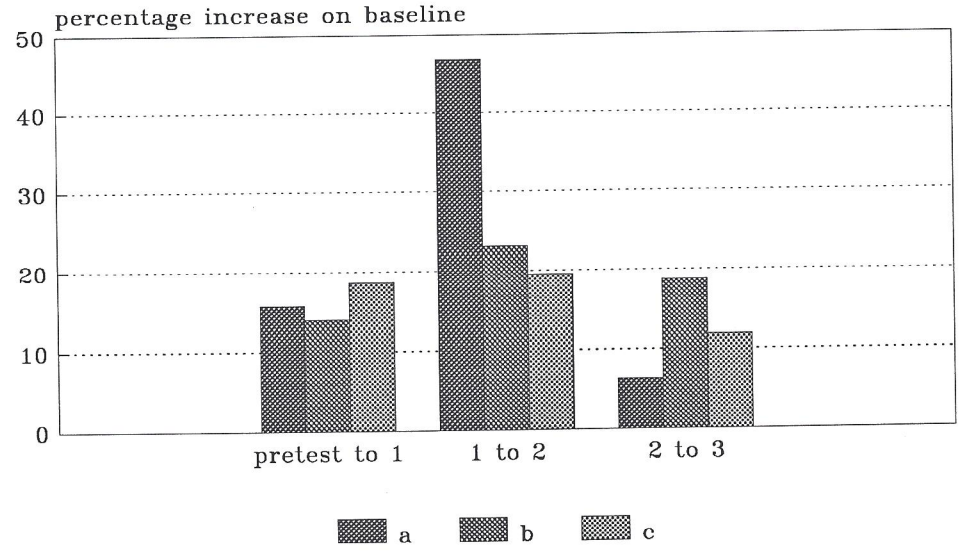


Lung function results:
FEV1 before and after teaching



1= before tuition; 2 & 3= after tuition.

percentage change in FEV1 across tests



1,2,3=first second and third post-test FEV1 tests. Pretest= before teaching.

Discussion of Results

The sample received no recent assessment, tuition or demonstration in relation in MDI technique. 52% of subjects reported no assessment or no demonstration of technique.

Previously, tuition and demonstration had been given by physicians or nurses. Only 12% of those checking technique were general practitioners who had prescribed the MDI. Subjects did not cite pharmacists as teachers or demonstrators of MDI technique, despite evidence of this profession's effectiveness (O'Bey et al and DeTullio et al 1987).

Factors preventing pharmacists being involved in patient education programmes at a local level may have been: the low number of pharmacy technicians, preconceptions concerning roles and poor morale which predisposed to the lack of interaction with patients.

This study, in common with other studies (Ellis and Friend 1985) found poor MDI technique generally. Many subjects were not using their MDIs effectively. Baseline variation with ORS measuring subject's performance, found poor average group scores (± standard deviation): highest: 9.33 ± 2.07 and lowest: 8.25 ± 1.93.

Expected and observed performance differed. Group A showed higher self-reported skills and knowledge of the MDI technique, but demonstrated lower objective performance of technique (ORS and AIM). Groups A and B self-rated lower on knowledge and ability to perform correct technique, but were better performers in comparison to group C.

Therefore, MDI technique needs objective assessment, even though subjects report competence.

From the sample (n=29), 86% of subjects had read their leaflet, 35% had not within six weeks of hospital admission, and 17% had not within the previous six years. Only 7% read the MWL with every newly prescribed inhaler. Subjects only receiving MWL (group A) did improve their inhaler technique during the study. Improvement for group A was significantly less than for group C receiving skills practice.

Findings from other studies employing video teaching techniques were not repeated (Self et al 1983 and Mulloy et al 1987). The video intervention had high content validity (Newman et al 1981). This study found that a video demonstration was not the most effective means of teaching such a skill.

Structured "skills" practice sessions were the most effective form of teaching MDI technique. Two out of the three means employed in the study to measure improvement in MDI technique (AIM and ORS), showed those subjects receiving skills practice (group C) experienced a greater average improvement in performing the MDI technique.

This supports findings of other studies employing similar practice interventions (Gayrard and Orehek 1980; Heringa et al 1987; Roberts et al 1982, and DeTullio et al 1987).

Direct observation after teaching with ORS, showed group C experienced three times greater improvement than group A, and two and a half times greater improvement than group B.

Group C had the greater percentage of improvement across all tests ; the greater percentage maintaining a good technique ; and the lowest percentage maintaining a poor technique between tests and as an average across the whole study.

The results of the aerosol inhalation machine (AIM) supported these findings. FEV1 measures in this study (FEV1) did not support either the observed performance or change in performance from, either ORS nor AIM. This may be due to differences in subjects' diagnoses on admission, different data analysis of FEV1 to DeTullio et al 1987, and difficulties with standardising the FVC test for subjects. All subjects were recovering from an acute illness. The majority of these (77%) were respiratory in origin eg. chest infections.

Measurement of performance in all components of the MDI technique vital for lung bronchodilation (Newman et al 1981) was completed. The method allowed performance feedback to subjects. Spirometry with AIM showed group C experienced a 23.3% performance increase in technique, this being 1.2 and 1.4 times groups A (19.4%) and B (17.3%) respectively.

Further Research

Many patients in the present study reported no assessment or even demonstration of recommended techniques. Specific, cost-effective and scientific means of measuring ability with metered-dose inhalers are necessary and desirable.

The observer rating scale may be a useful assessment tool but needs training resources in order to ensure reliability.

The aerosol inhalation machine (AIM) is an objective means of helping patients to learn the MDI technique. Training may be a structured activity, advancing on the machine through three stages: firing, drug-delivery and breath-holding. From this study, the aerosol inhalation machine appears a useful training tool.

Subjects in this study receiving nurse training with AIM, initially improved their MDI technique significantly. A further study would examine the effect of continuing the training over a period of time. Other studies have demonstrated improvements in MDI technique with repetitive training eg. O'Bey et al 1982.

The research monitoring of healthy subjects in AIM training, together with ORS and lung function measures, is recommended. This would :

a. Examine training abilities of MDI users not recovering from a hospital admission.
b. Correlate the significance of ORS, AIM and spirometric measures (such as FEV1) more closely.

Analysis of differences between measures employed should be undertaken. Data analysis of lung function (FEV1) was not undertaken as in DeTullio et al 1987. FEV1 measures employed in this study did not support either the observed performance or change in performance (AIM or ORS).

Further studies should concentrate on diverse methods of using the machine with subjects. Tentatively only two methods were employed in this study : as a measuring tool and/or as a feedback/training device.

The role of skills practice is also worthy of further research. Particular reference could be made to factors promoting an optimum performance eg. kinetic, visual and proprioceptive . A thorough review of the literature on skills practice is demanded.

Nurses, pharmacists, and physicians need to be more aware of patients' training deficiencies. Several studies already highlight poor physician abilities with MDIs eg. Kelling et al 1983; Frew and Macfarlane 1984. Physicians (and especially General Practitioners) are the prescribers for patients, and therefore have both a responsibility and an opportunity to demonstrate correct technique. Further research would examine specific causes of poor performance.

The fact that nurses are not cited as teachers or demonstrators of technique may be due to training deficiencies with particular regard to the needs of the respiratory client. The reason for poor MDI technique amongst nurses is not made evident in other studies eg. Henney and Blatt 1984. Further research is needed with many grades of nursing staff to examine specific training needs.

Recommendations

Respiratory Nursing Consultant

This study forms a further basis for the role of respiratory health worker (RHW). Nursing research already supports such a role (Bagnall and Heslop 1987; Bagnall and Heslop 1988).

The RHW role would have a wide clinical practice and nursing research remit across a receptive health district, and would address specific training needs of all health care professionals.

In the United Kingdom respiratory care is not an established nursing speciality (unlike the USA). The health care needs of respiratory clients are not specifically addressed. Statutory post-basic nurse education and training are non-existent for those nurses wishing to specialise in respiratory care.

Health districts have difficulty in accommodating such roles within existing budgets. However, with implementation of proposals in the White Paper on the National Health Service (HMSO 1988) it may be possible for some authorities to contract-in specialist nursing consultants.

The Royal College of Physicians' (RCP) Committee on Thoracic Medicine (1981) have made extensive recommendations for this role. Training needs have been discussed by the Royal College of Nursing and the British Thoracic Society. Sufficient nursing research exists to support such a role. However, at present only one health district in the United Kingdom has instituted and researched the RCP recommendations.

Training Needs of Respiratory Nursing

The specific training needs of nurses caring for respiratory clients are called into question by the current small-scale study. Evaluation of a seemingly "simple" procedure such as correct MDI technique, demands scientific knowledge and assessment skills.

Several authoritative texts are available for the respiratory nurse specialist eg. Sexton D.L. (ed) 1990. A multidisciplinary training is currently offered to the nurse specialist and physician for patients with asthma (Pearson 1988).

In the area of assessment, further research should concentrate on the assessment tools which nurses require. Varied tools already exist within nursing and the physical and social sciences.

This small-scale study did not employ any assessment tool drawn from a nursing model. Assessment tools derived from a model of nursing have been employed in nursing research designs eg. Bagnall and Heslop 1988. Together with the present study, such formative work provides the basis for training developments.

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