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Original Contributions

EFFICACY AND COST COMPARISONS OF BRONCHODILATATOR ADMINISTRATION BETWEEN METERED DOSE INHALERS WITH DISPOSABLE SPACERS AND NEBULIZERS FOR ACUTE ASTHMA IN AN INNER-CITY ADULT POPULATION

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□ **Abstract—Background: Despite demonstration of equivalent efficacy of beta agonist delivery using a metered dose inhaler (MDI) with spacer vs. nebulizer in asthma patients, use of a nebulizer remains standard practice. Objectives: We hypothesize that beta agonist delivery with a MDI/disposable spacer combination is an effective and low-cost alternative to nebulizer delivery for acute asthma in an inner-city population. Methods: This study was a prospective, randomized, double-blinded, placebo-controlled trial with 60 acute asthma adult patients in two inner-city emergency departments. Subjects (n = 60) received albuterol with either a MDI/spacer combination or nebulizer. The spacer group (n = 29) received albuterol by MDI/spacer followed by placebo nebulization. The nebulizer group (n = 29) received placebo by MDI/spacer followed by albuterol nebulization. Peak flows, symptom scores, and need for rescue bronchodilatator were monitored. Median values were compared with the Kolmogorov-Smirnov test. Results: Patients in the two randomized groups had similar baseline characteristics. The severity of asthma exacerbation, median peak flows, and symptom scores were not significantly different between the two groups. The median (interquartile range) improvement in peak flow was 120 (75–180) L/min vs. 120 (80–155) L/min in the spacer and nebulizer groups, respectively ($p = 0.56$). The median improvement in the symptom score was 7 (5–9) vs. 7 (4–9) in the spacer and nebulizer groups, respectively ($p = 0.78$). The median cost of treatment per patient was $10.11 ($10.03–$10.28) vs. $18.26 ($9.88–$22.45) in the spacer and nebulizer groups, respectively ($p < 0.001$). Conclusion: There is no evidence of superiority of nebulizer to MDI/spacer beta agonist delivery for emergency management of acute asthma in the inner-city adult population. MDI/spacer may be a more economical alternative to nebulizer delivery. © 2009 Published by Elsevier Inc.**

□ **Keywords—spacer; metered dose inhaler; MDI; asthma; nebulizer; emergency department; inner city**

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INTRODUCTION

Asthma affects approximately 14 million adult Americans and accounts for more than 450,000 hospitalizations annually. Approximately 1.8 million asthma patients require emergency department (ED) visits each year. Rates of hospitalizations and ED visits related to asthma are greatest in the Northeast, especially in New York City. Among New York City's five boroughs, the two economically depressed areas of the Bronx and Brooklyn

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boroughs had the highest hospitalization rates of 75 and 52 per 10,000, respectively. Economically disadvantaged inner-city adults, particularly the African-American and Hispanic populations, are more susceptible (1,2). The ethnic differences in prevalence, morbidity, and mortality, along with frequent hospitalizations and ED visits, are highly correlated with poverty and inadequate access to medical care. Other factors that may play a role include urban air quality, indoor allergens, scarcity of patient education programs that are culturally and linguistically appropriate, and lack of self-management skills.

Because the inner-city patient population tends to frequently use the ED rather than a primary physician as the primary source of asthma care, management strategies in the ED should be appropriately designed, with the clinical effectiveness, efficiency, and economics being taken into consideration (3). Patients with acute asthma are usually treated with nebulized albuterol in the ED and in the inpatient setting after admission. An albuterol metered dose inhaler (MDI) with a spacer can be used alternatively, allowing the patient to inhale aerosol from the MDI without the need to coordinate the actuation of MDI and inhalation, a step many patients have difficulty learning (4).

The MDI/spacer combination has been evaluated in adults with mild, moderate, and severe acute asthma in various settings, including the outpatient department, inpatient ward, ED, and intensive care settings (5–14). Although greater bronchodilatator response might be expected with a nebulizer due to the higher dose used for nebulization compared with standard measured-dose inhalers, studies comparing delivery of beta agonist with MDI plus a spacer vs. a nebulizer show no difference with respect to clinical response in acute severe asthma and stable chronic asthma (9,15–26). In addition, extrapulmonary sympathetic effects such as tremor, anxiety, and dysrhythmias were found in one study to be more prevalent in patients receiving nebulized medication compared to MDI/spacer-delivered medication (27). Albuterol administered by a spacer and MDI, therefore, is an effective alternative to a nebulizer (28).

Despite the demonstrated equivalency, rapid delivery, and lesser use of personnel resources with the MDI/spacer combination, nebulized albuterol remains the standard therapy for patients with acute asthma (29). Patients' perception of the nebulizer being more effective, the lack of coordination between MDI actuation and inhalation when using an MDI/spacer during acute asthma, especially for first time users, and the notion that delivery with non-disposable commercial spacers is more expensive, has limited the use of spacers in the ED. Most studies comparing the two modes of delivery in adults have been conducted in the ambulatory and inpatient settings. Although some have been done in the ED setting, to our knowledge, none has focused on an inner-city adult patient population who most frequently use the ED as a primary source of asthma care.

We hypothesized that albuterol delivered with a disposable spacer would be an efficient, cost-effective alternative to nebulized albuterol treatment for inner-city adult asthma patients presenting to the ED.

METHODS

The study was approved by the Committee of Clinical Investigations. It was conducted as a prospective, randomized, double-blinded, placebo-controlled trial in adult patients with acute asthma presenting to the EDs of two acute-care inner-city teaching hospitals (total ED visits approximately 88,000/year) in the borough of the Bronx in New York City.

Patients

Patients who presented to the ED with acute exacerbation of asthma as defined in the NAEPP (National Asthma Education and Prevention Program) Expert Panel Report II were eligible to participate in the study if they met the following criteria: 1) diagnosis of asthma, 2) age 18–70 years, and 3) ability to perform peak flow maneuvers with good effort (30). Patients were excluded for any of the following reasons: 1) requiring intubation and mechanical ventilation, 2) smoking history $>$ 20 pack years, and 3) the presence of coexistent systemic diseases such as congestive heart failure, pulmonary disease other than asthma such as pneumonia, tuberculosis, bronchiectasis, interstitial lung disease, sarcoidosis, pleural diseases, kyphoscoliosis, chronic obstructive pulmonary disease, renal failure, or cancer.

All patients who met the eligibility criteria and signed the informed written consent were enrolled.

Study Design

Patients were recruited for the study from August 2004 to August 2005 and were randomly assigned to the study group (MDI/disposable spacer combination) or control group (Nebulizer). Patients were enrolled 24 h a day by either the investigators or housestaff specifically trained by the investigators, who were responsible for maintaining the study records. Randomization codes were selected by a pharmacist who was not involved in the study, using a randomization table with a block size of four. Codes for the study groups were known only to the

pharmacist. All personnel involved in patient recruitment and medication delivery were blinded to the randomization. A disposable and collapsible, dual-valve holding chamber for use with MDI LiteAire (Thayer Medical, Tucson, AZ) was utilized for the study. Placebo MDIs were prepared by a pharmacist who was not involved in the study or in the assignment of randomization codes. All patients received treatment with the MDI/spacer combination and nebulizer. The MDI/spacer group received 540 μg of chloroflourocarbon (CFC) albuterol by MDI (six actuations of 90 μg/actuation; Warwick Pharmaceutical Corporation, Reno, NV) with the spacer followed by 3 mL of normal saline solution (0.9%) by nebulizer every hour until disposition. The Nebulizer group received six actuations of placebo MDI with spacer followed by 2.5 mg (3 cc) albuterol (Dey, Napa, CA) by nebulizer (Cardinal Health Edison, NJ) on a similar schedule. MDI was shaken before each actuation and medication was administered one actuation at a time into the spacer. Each actuation was delivered just before inhalation and the aerosol was inhaled from the spacer by six tidal breaths. All MDI/spacer treatments were self administered by the patient after a one-time demonstration of its use by a respiratory therapist (RT). All nebulizer treatments were administered by a RT in the asthma treatment room in the ED. The RT documented in the electronic medical chart the vital signs, room air oxygen saturation, lung examination, and a pre- and post-treatment peak flow rate for every treatment administered. The RT managing the patient care was supervised by the emergency physician on duty. Patients also received rescue treatments with albuterol nebulization as required. Oral or intravenous steroids were administered at the discretion of the emergency physician.

A baseline peak flow measured by a Wright peak flow meter and a "symptom severity score" were recorded for each patient at the start of the study, and every hour until disposition. Based on each patient's perception of severity of symptoms, a score of 0–3 was assigned, each for shortness of breath, chest tightness, wheezing, and cough (0 for none, 1 for mild, 2 for moderate, 3 for severe), and a total score was calculated as the sum of each individual score, allowing a maximum of 12 (Figure 1). A higher score reflected a greater severity of symptoms and a decreasing score indicated improvement. Both groups were followed for their expiratory peak flow, symptom severity, and the number of rescue bronchodilatator treatments every hour for a maximum of 6 h. The triage decision to admit or discharge a patient from the ED was made within 6 h of enrollment into the study, and the study was terminated once the patient was discharged home or admitted to the hospital. Patients were discharged home after ED treatment based on the improvement in the underlying disease severity as assessed by the peak flow. The discharge criterion was peak flow rates $>$ 70% predicted (31). Patients were discharged home with specific therapy based on NAEPP guidelines (30).

Symptoms Severity Score
1) Shortness of Breath
2) Chest Tightness
3) Wheezing
4) Cough
Point assessment for each symptom 0-none 1-Mild 2-Moderate 3-Severe
Total score derived by Sum

Figure 1. Symptom severity score.

Outcomes

The primary outcomes measured were changes in patients' symptoms and peak flow rates, and disposition (i.e., admission to hospital or discharge to home from the ED). Secondary outcome measures were length of stay in the ED, cost of therapy, and the number of rescue treatments required. The length of stay was calculated from the time of enrollment into the study until the time the decision was made regarding the patient's disposition. In the case of patients whose stay in the ED was prolonged for reasons other than medical, the time of disposition was taken as the time they met the criteria for admission to the medical ward or discharge home. Cost analysis for each group included the cost of medication, equipment (spacer vs. nebulizer kit), and labor (time spent by the respiratory therapists, for the active medication only). The cost of placebo medication, the device to deliver placebo, and the labor to administer it were excluded from analysis.

Statistical Analysis

Insofar as we did not have an a priori estimate of an effect size difference with which to project a sample size, we undertook to enroll as many eligible consecutive participants as possible within the 1-year enrollment period for the study. Entry characteristics between the two treatment groups were compared to assess whether the randomization achieved a reasonable balance. p Values are provided as a guide to this assessment with the understanding that the formal interpretation of p is not applicable to random assignment. Categorical variables are presented as percentages and compared with chi-squared. Continuous variables within each of the study groups did not meet normality assumptions. Values are presented as median (interquartile range [IQR]) and between-group comparisons made with the non-parametric

Table 1. Baseline Characteristics

Characteristic	LiteAire Group (n = 29)	Nebulizer Group (n = 29)	Total n = 58	*p** Value
Age (in years) (%)				0.15
< 30	35	52	43	
30–50	41	41	41	
> 50	24	7	16	
Females (%)	83	59	71	0.04
Race (%)				0.47
African-American	38	52	45	
Caucasian	7	3	5	
Hispanic	55	41	48	
Other	0	3	2	
Smokers (%)	52	35		0.19
Intubation history (%)	10	7	9	0.64
Asthma duration > 10 years (%)	76	79	78	0.75
Peak flow rate (L/min)	220 (165–315)	260 (190–360)	250 (180–343)	0.37
Symptom score	8 (7–11)	9 (7–11)	9 (7–11)	95

* Analysis of continuous variables (presented as median and interquartile range) by the non-parametric Kolmogorov-Smirnov test and categorical variables (presented as % by chi-square). Treatment group was by random allocation, so that both groups came from the same population. Thus, *p* values have been given only as a convenient gauge of the effectiveness of the randomization and should not to be given a formal interpretation.

Kolmogorov-Smirnov test. Normality assumptions were met sufficiently for the sample as a whole to allow linear regression models to assess potential confounding. All tests used a two-tailed alpha of 0.05 for statistical significance, and analyses were performed with SPSS for Windows software (version 13; SPSS Inc., Chicago, IL).

RESULTS

We screened 75 patients who presented to our adult ED for an asthma exacerbation. Of 75 patients screened, 5 did not satisfy eligibility criteria and 10 did not give consent for participation in the research. The remaining 60 patients were randomized into two study groups, 30 in each group. One patient from each group was not included in the outcome analysis because one withdrew consent and the other signed out against medical advice, leaving 29 per group for the study sample. Entry characteristics for the two randomized treatment groups were similar in terms of race, intubation history, asthma duration > 10 years, steroid administration, peak flow rate, and symptom severity score (Table 1). Of the patients enrolled, 48% were Hispanic and 49% were African-American. Smoking history was not significantly different between the two groups. The MDI/spacer group had a higher percentage of female patients and was at a somewhat higher mean age.

Disposition (discharged home or admitted to hospital) was similar between the groups ($p = 0.55$). One patient in the MDI/spacer group and 2 in the Nebulizer group were admitted to the hospital (3% vs. 7%, respectively), whereas 28 patients in the MDI/spacer group and 27 in the Nebulizer group (97% vs. 93%, respectively) were discharged home at the completion of the study (Table 2).

Medians (IQR) for increase in peak flow from entry to disposition were similar for the two groups, with 120 (75–180) L/min for the MDI/spacer group and 120 (80–155) L/min for the Nebulizer group ($p = 0.56$) (Table 2). Symptom severity scores were also similar ($p = 0.78$). At least one rescue bronchodilatator treatment was necessary for 24% of the MDI/spacer group, compared to 21% of the Nebulizer group ($p = 0.75$). The median length of ED stay was 2 h for both groups, with an IQR of 1.5–3.0 h for the MDI/spacer group and an IQR of

Table 2. Outcomes by Treatment Group

Outcome*	LiteAire (n = 29)	Nebulizer (n = 29)	*p* Value
Peak flow rate increase (L/min)	120 (75, 180)	120 (80, 155)	.56
Symptom severity decrease	7 (5, 9)	7 (4, 9)	.78
Disposition (%)			.55
Home	97%	93%	
Admitted	3%	7%	
Length of stay in ED (hours)	2 (1.5–3)	2 (1–2.5)	.78
Received rescue treatments (%)	24%	21%	.75
Steroids administered in ED (%)	59	62	.79

* Peak flow rate increase, symptom severity decrease, and length of stay in ED are presented as median (interquartile range) and compared with the non-parametric Kolmogorov-Smirnov test. Disposition and receiving rescue treatments are presented as % and compared by chi-square.
ED = emergency department.

Table 3. Costs by Treatment Group

	Lite Air	Nebulizer	*p* Value
Cost of delivery system	$2.95	$ 1.50	—
Cost of medications*	$ 0.34 (0.26–0.51)	$ 0.38 (0.19–.48)	0.37
Cost of respiratory therapist*	$ 6.82 (6.82–6.82)	$ 16.38 (8.19–20.48)	< 0.001
Total cost*	$10.11 (10.03–10.28)	$ 18.26 (9.88–22.45)	< 0.001

* Median (interquartile range). *p* Values calculated with the non-parametric Kolmogorov-Smirnov test except for delivery system, which was constant for both groups, and thus a *p* value is not applicable.

1–2.5 h for the Nebulizer group ($p = 0.78$). Adjusting for age and gender did not meaningfully change the results. In post hoc power analysis, with 29 participants per group, there was 95% power to detect if the MDI/spacer was > 50% less effective than the nebulizer for increasing peak flow rate, and 43% power to detect if the MDI/spacer was 25% less effective. Similarly, there was > 99% and 59% power, respectively, with regard to decrease in symptom severity scores.

The cost analysis for the two groups is summarized in Table 3. Our cost calculations were based only on treatments with albuterol in each arm and did not include placebo administration. Payroll costs (including fringe benefits) for a respiratory therapist in our institutions is on average $40.94 per hour. The RT needed about 10 min to instruct and demonstrate the use of an MDI/spacer to a patient, just once for the entire ED stay. For the Nebulizer group, it required an average of approximately 12 min per treatment. Thus, the cost for the RT time represents the biggest difference in costs between the two groups, with a constant $6.82 per patient in the MDI/spacer group and a median of $16.38 (IQR 8.19–20.48) for the Nebulizer group ($p < 0.001$). There was a one-time cost per patient for the delivery system of $2.95 for the LiteAire Spacer and $1.50 for the nebulizer. Per-treatment costs of the medication were $0.17 and $0.19 for MDI/spacer and nebulizer, respectively. Total costs were significantly lower ($p < .001$) for the MDI/spacer group, with a median of $10.11 (IQR 10.03–10.28) compared to $18.26 (IQR 9.88–22.45) for the Nebulizer group.

DISCUSSION

In this study, we demonstrated that beta-agonist delivery with MDI/spacer and nebulizer have equivalent efficacy for adult patients with mild to moderate asthma exacerbation in two inner-city EDs. We found no meaningful differences in number of admissions, changes in median peak flow rate, median symptom score, number of rescue bronchodilatator treatments, or length of stay in the ED between those treated with bronchodilatators using the MDI/spacer combination compared to those treated using a standard nebulizer delivery system. Although the spacer group tended to be female and older, neither sex nor age was significantly associated with any of the outcome measures. Our results are comparable to a number of prior studies that revealed equivalent performance for MDI/spacers and nebulizers.

In 2005, the American College of Chest Physicians/American College of Asthma, Allergy, and Immunology published evidence-based guidelines regarding device selection and outcomes of aerosol therapy in various clinical settings based on a meta-analysis of 59 randomized controlled trials (RCT) (32). Of the 19 RCTs that compared aerosol delivery devices in the ED, the nine studies that compared β_2-agonist delivery by nebulizer to that by an MDI with a spacer/holding chamber in adult patients with acute asthma did not report a significant difference in pulmonary function response to the two methods of delivery. Only two of the nine studies reported any significant differences between the two groups for time spent in the ED, hospital admission rate, and frequency of ED discharge at 6 h.

A Cochrane Database meta-analysis updated in 2006 by Cates et al. assessed the effects of spacers compared to nebulizers for the delivery of beta agonists for acute asthma (33). The updated review now includes data from 614 adults randomized in 25 trials from the ED and community settings in addition to the inpatient trials. The outcomes measured in the trials include hospital admission rates, length of stay in the ED, respiratory and pulse rates, blood gases, and lung function. In this meta-analysis, the delivery of beta agonists using a spacer did not seem to affect hospital admission rates for adults when compared to beta agonist delivery using a nebulizer, with the relative risk of admission for spacer vs. nebulizer being 0.97 (95% confidence interval 0.63–1.49). The length of stay in the ED, peak flow rate, and forced expiratory volume were also similar for the two delivery methods. Several methodological limitations, including the lack of standardized spacer device, beta-agonist dose, and reporting of the data regarding lung function tests in many studies, may restrict the generalizability of these results

to patients presenting to the ED with an exacerbation of asthma.

The cost analysis in our study that took into account equipment, medication, and labor costs revealed that there was a significant cost reduction utilizing LiteAire Spacer vs. a nebulizer. The largest component of the savings was related to the difference in the labor costs associated with the two delivery systems. Other studies have demonstrated similar differences in the labor costs between the two modes of treatment. However, when analyzing the labor cost, there is a large variability in the studies with respect to duration of time spent by the RT during nebulizer delivery. The reported time ranges from 4 to 20 min in different studies (5,9,34–37). In our study, the median time spent by the RT was 12 min. To see the general applicability of this study from a cost perspective, we looked at the cost of other currently commercially available spacers. The hospital price range for other spacers is between $5.23 and $12.00, a two- to four-fold difference from the spacer device utilized in this study. The cost of other commercially available spacer devices, therefore, would seem to counterbalance the savings derived from the labor economics. Because the spacer cost in our study is not markedly different from the thrifty nebulizer cost, the difference between the two groups remains significant. An additional factor of economic significance could be the use of CFC albuterol MDI in our study as opposed to the hydroflouroalkane (HFA) albuterol. Effective December 2008, the US Food and Drug Administration (FDA) has mandated the use of HFA albuterol only. Of note is that, unlike a significant difference in the cost of HFA albuterol vs. CFC albuterol in ambulatory and inpatient settings, the current hospital cost for HFA albuterol MDI for patients in the ED is similar to the CFC albuterol. Hence, the new FDA mandate to use HFA albuterol has no significant cost implications. Our findings are parallel to other studies that have compared MDI/spacers to nebulizer therapy and demonstrated a cost benefit to MDI/spacers (13,33,34).

There is a wide variation in the bronchodilatator dose (1:1 to 1:12.5) reported in the literature in studies comparing the two modes of delivery in the ED setting (38). Also, potential dose-related adverse effects of beta agonists have been reported in studies comparing the use of nebulizers to MDIs in asthma patients. Extra-pulmonary sympathetic effects such as tremor, anxiety, and tachycardia have been found to be more prevalent in patients receiving nebulized medication compared to MDI/spacer-delivered medication (33,34). The choice of the bronchodilatator dose for our study was based on results of previous studies of children and adults demonstrating the comparability of six actuations of albuterol MDI (540 μg) with spacer to 2.5 mg delivered by nebulizer (26,39–42). No adverse side effects were found in any of the patients enrolled in this study.

In our literature search, we did not find a validated asthma severity scoring system for adults. This was exemplified by a small pilot study that revealed that the correlation between wheezing and peak flow was weak (43). However, in a prior study, when we studied multiple subjective symptoms, giving each symptom a severity rating, we found a reliable correlation between the cumulative severity symptom score and peak flow (44). Hence, we chose to utilize the same symptom scoring system in this study. It is our belief that the scoring system utilized in our study can be used when conducting other outcome studies, although validation of the scoring system in a larger clinical trial would be desirable.

For patients who have poor coordination between actuation of MDI and inhalation, spacer use is particularly valuable because it usually requires only a brief demonstration of the proper use of a MDI/spacer device to improve user skills (5,45,46). In our study, patients found it easy to learn to use the spacer device regardless of educational background and socioeconomic status. The compact spacer we utilized is made of collapsible cardboard that can be used for up to 1 week. Drug delivery using the LiteAire device has been shown to be equivalent to other valved holding chambers like the Aerochamber Plus® (Forest Pharmaceuticals Inc., St. Louis, MO) spacer device (47).

Limitations

A major limitation to our study was the relatively small sample size. Although we had adequate statistical power to be confident that the MDI/spacer was not $>$ 50% less effective than the nebulizer to increase peak flow rate or decrease symptom severity score, the statistical power was not sufficient to have similar confidence with regard to smaller differences. Nonetheless, the point estimates of the median values for peak flow rate increase, severity of symptoms score, and length of stay in the ED were exactly the same for both groups. Furthermore, one patient in the MDI/spacer group needed hospitalization, compared to 2 patients in the Nebulizer group.

Another limitation is that the majority of patients had mild to moderate severity of asthma exacerbation because the study recruitment was mostly limited to patients managed by a respiratory therapist, whereas those who were in status asthmaticus were managed by the emergency physicians and excluded from this study. Our study could have been more robust had we collected data on the baseline use of albuterol or spacers, as well as patient returns to the ED after discharge. Because our trial was limited to only 6 h in the ED, and we did not

send the patient home with the spacer or conduct a follow-up post-disposition, we are unable to comment on these clinical outcomes. Future studies should include a longer follow-up and collection of the aforementioned data.

Although larger studies have reported the equivalence of the MDI/spacer combination and nebulizer in adults with acute respiratory disease, our study has the strength of being one of the few conducted in a predominantly minority population in the inner city with a double-blinded, randomized protocol. Comparing spacer vs. nebulizer in the ED for the minority patient population is most relevant because this group utilizes the ED most frequently (3,48,49). Most of the earlier comparison studies did not report data on race (8,15,27,32,33,50–53). We could find only one prior study in an inner-city ED where 70% of the patients enrolled were African-American, but there were few Hispanic patients (54). Our findings argue for a larger, multi-center trial to assess equivalence and cost benefit for an MDI/spacer combination.

CONCLUSION

We found no evidence that a conventional nebulizer was more efficacious than a spacer device for bronchodilatator therapy in adults with acute exacerbation of asthma. Additionally, using a spacer device may result in a marked reduction in time and effort invested by the respiratory therapist and, consequently, savings in the total cost for asthma treatment in an inner-city ED setting.

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ARTICLE SUMMARY

1. Why is this topic important?

Asthma exacerbations are costly to manage. In addition to therapies that increase asthma control and reduce the frequency or severity of exacerbations, other efforts to decrease cost may bring economic benefits. Inner-city patients frequently use the emergency department (ED) for asthma exacerbations. This study presents data on the use of a metered dose inhaler with spacer as a cost-effective alternative to nebulizer therapy for use in acute exacerbation of asthma in an inner-city ED. Hence, an alternate mode of B- agonist delivery may reduce the number of ED visits. Although nebulizer use for bronchodilatator delivery in asthma exacerbation requires longer delivery times and greater resource utilization, their use is the standard of care due to the expense of commercially available spacer devices, which would otherwise be a viable alternative. This study presents data on the use of MDI with spacer as an efficient, cost-effective alternative to nebulizer for use in acute exacerbation of asthma in the inner-city population.

2. What does this study attempt to show?

This study attempts to demonstrate that albuterol delivered with spacer is an efficient, cost-effective alternative to nebulized albuterol treatment for asthma patients in the ED in an inner-city hospital.

3. What are the key findings?

Albuterol delivery using the nebulizer or spacer in patients with acute asthma exacerbation resulted in equivalent improvements in peak expiratory flows and asthma symptoms in patients, in this randomized, double-blinded, placebo-controlled trial. The number of rescue treatments required in the two groups and the length of ED stay were also equivalent .The cost was significantly less for the spacer device. Most of the cost benefit was derived by the amount of time the respiratory therapist spent with the patient.

4. How is patient care impacted?

This study demonstrates that use of spacer devices may decrease the economic burden of asthma management without compromising the quality of care delivered in an inner-city patient population who frequently use the ED for managing their asthma.