**AeroEclipse® II Users Report:**

**Breath Actuated Nebulizer (BAN)**

- $186,789 Annual Facility Savings \(^{(1)}\)
- 50-68% Reduction in Treatment Time \(^{(4,7,8,11)}\)
- 8-9% Reduction in ALOS \(^{(4,7)}\)
- 18% Reduction in LOS in ED \(^{(5)}\)
- 33% Reduction in LOS in Pediatric ED \(^{(6)}\)
- 25% Reduction in OT Hours \(^{(12)}\)
- 68% Savings in Labor Cost \(^{(8)}\)
- 16% - 50% Reduction in Admissions \(^{(2,3,6,9)}\)
- Avoid Potential Intubations \(^{(13)}\)

---

1. **REDUCING TOTAL COSTS OF AEROSOLIZED MEDICATION DELIVERY USING THE AEROECLIPSE II BREATH ACTUATED NEBULIZER**

   Wilson, J.
   Forsyth Medical Center, Winston Salem, NC

   **Study Found**

   **Synopsis**
   We hypothesized the AeroEclipse® II breath actuated nebulizer combined with an aggressive dosing and frequency protocol would result in cost savings. We transitioned a 38 bed pulmonary unit from traditional jet nebulizers to BAN nebulizers and developed a medication dosing and frequency protocol. Frequencies were changed from Q4 to Q6 and QID to TID. BANs were changed weekly versus daily with traditional nebulizers. Average hourly rate, treatment time, drug costs and device costs for June through November 2008 were compared to 2007.

   **Significant Findings**
   Use of BAN nebulizers resulted in an annual savings at Forsyth Medical Center of $186,789 and estimated savings of $475,411 across Novant Health facilities. Our initial 2008 conversion resulted in a 20% decrease in total costs. Additionally a 31% decrease in minutes per day in therapist time to administer medications and 21% increase in duration between treatments was realized. The BAN nebulizers accounted for an 18% decrease in total costs and 19% decrease in total treatment time. Using the AeroEclipse® II breath actuated nebulizer in conjunction with an aggressive medication dosing and frequency reduction protocol provides significant savings.

2. **RANDOMIZED CONTROLLED TRIAL OF A BREATH-ACTUATED NEBULIZER IN PEDIATRIC ASTHMA PATIENTS IN THE EMERGENCY DEPARTMENT**

   Sabato, K., Ward, P., Hawk, W., Gildengorin, V., Asselin, J.
   Children’s Hospital and Research Center Oakland, Oakland, CA

   **Study Found**
   Resp Care 2011 June;56(6):761-770.

   **Synopsis**
   Bronchodilator treatment for asthma can be provided with various aerosol-generating devices and methods. There have been no randomized trials of a breath-actuated nebulizer versus continuous 1-hour nebulization and/or small-volume constant-output nebulizer in pediatric asthma patients. We conducted a randomized study of one-time albuterol treatment with the AeroEclipse® breath actuated nebulizer versus standard therapy in pediatric asthma patients in the emergency department. We assessed all our patients with our clinical asthma scoring system and peak flow measuring measurement if possible. We recorded the time in the emergency department, change in clinical asthma score, need for additional bronchodilator treatments, need for admission, patient response ability actuate the AeroEclipse® BAN and adverse effects.

   **Significant Findings**
   Fewer AeroEclipse® BAN patients required hospital admission (40%) to standard therapy (62%) whereas the continuous nebulization patients had the highest admission rate (65%). AeroEclipse® BAN uses less albuterol and less time, with improved efficiency and a lower admission rate than continuous nebulization for the initial aerosol treatment in the ED. Our results show that albuterol delivery via AeroEclipse® BAN as the initial treatment for asthma patients in our ED is more effective than initial treatment with continuous nebulization. Overall, AeroEclipse® BAN patients had significantly better improvement in clinical asthma score, better decrease in respiratory rate, and a lower admission rate.
COMPARING A BREATHE-ACTUATED NEBULIZER VS. A CONVENTIONAL CONTINUOUS-OUTPUT NEBULIZER IN TREATING ACUTE ASTHMA IN A PEDIATRIC EMERGENCY DEPARTMENT: AN ONGOING RANDOMIZED CONTROLLED TRIAL
Rose, J.A., Cancelliere, S., Matye, P., Nair, S., O’Riordan, M.
Rainbow Babies and Children’s Hospital/Case Medical Center, Cleveland, OH

Study Found

Synopsis
A Breath-Actuated Nebulizer (BAN) is a newer type of nebulizer that creates aerosol only during a patient’s inhalation. Little is known regarding effectiveness of BAN devices in treating pediatric asthma patients. Participants are children aged 1 through 17 years presenting to a pediatric ED for treatment of acute asthma. Following an initial bronchodilator treatment with a conventional continuous-output nebulizer, participants requiring further treatments are randomly assigned to receive treatments with either a BAN or standard continuous-output nebulizer until meeting established discharged criteria. In each group, participants are treated with an identical regimen of frequent bronchodilator treatments and oral dexamethasone with clinical reassessment every twenty minutes according to a standard asthma care algorithm. In addition, participants complete a survey regarding satisfaction with the assigned device at the end of their ED visit.

Significant Findings
Overall, 32.9% of 76 patients in the BAN group have required hospitalization compared with 44% of 75 in the continuous nebulizer group. Among participants enrolled thus far, the rate of hospitalization for acute asthma is lower in those assigned to the BAN group compared to those in the continuous-output group. A greater percentage of participants have indicated a high level of comfort with use of the BAN device.

IMPACT OF A BREATHE ACTUATED NEBULIZER PERFORMANCE IMPROVEMENT ON HOSPITAL LENGTH OF STAY
Emberger, J., Brown, J.M., Killian, L., Maheshwari, V.
Christiana Care Health System, Newark, DE

Study Found
Resp Care 2009 Nov;54(11):1571.

Synopsis
Newer nebulizer technologies have been developed that may improve delivery of medications as well as shorten the duration of therapy time. We have been investigating ways that we can provide better care and eliminate concurrent respiratory therapy. A performance improvement project was approved by our Pharmacy and Therapeutics Committee, to evaluate performing one-on-one nebulizer therapy with a breath actuated nebulizer (Aeroeclipse II, Monaghan Medical). We wanted to determine if timed breath actuated nebulizer (BAN) therapy impacted patient length of stay in the hospital.

Significant Findings
Bronchodilator treatment for patients with obstructive diseases such as Asthma and COPD have conventionally used standard small volume jet nebulizers. Our study compared the use of breath actuated nebulizers versus small volume nebulizers to evaluate the primary endpoint of hospital LOS in patients with COPD, Asthma, or both. Actual treatment time was 3 minutes or less which allowed respiratory staff to eliminate concurrent therapy. Treatment with BAN resulted in a statistically significant reduction in hospital LOS when compared to historical reference and concurrent reference patients with COPD and Asthma. Wider prospective studies to evaluate this therapy are needed.

DECREASING THE LENGTH OF STAY IN THE EMERGENCY DEPARTMENT FOR PATIENTS DISCHARGED WITH ASTHMA
Hart, M.K., Alexander, V., Daniel, E., D’Etienne, J., Millard, M.
Baylor University Medical Center, Dallas, TX

Study Found
Resp Care 2009 Nov;54(11):1528.

Synopsis
On an average, 80 adult asthma patients are treated in the Emergency Department (ED) at Baylor University Medical Center each month. The average length of stay (LOS) is 278 minutes for those discharged and 516 minutes for those admitted. Asthma can be controlled with proper treatment and ED management should take no longer than 180 minutes based on Expert Panel Report 3. The opportunity for improvement was evident. A quality improvement multidisciplinary Asthma ED Team was formed to determine what was causing the significant LOS. The team leader coordinated and facilitated meetings with MDs, RTs, and RNs. Quality improvement tools, such as a fishbone cause and effect diagram, run charts, and affinity charts, were used to help identify and prioritize problems identified by the team. During the first brainstorming session the team discovered that no standardized asthma protocol existed for ED staff to follow. An asthma protocol was developed and FEV1 meters were given to all RTs to use to determine severity and treatment effectiveness. A breath actuated nebulizer (BAN) was introduced to deliver all bronchodilator therapy more effectively and safely. Staff was educated on the asthma guidelines, choice of medications, how to use the protocol, document, and communicate effective patient handoff.

Significant Findings
After implementing the asthma protocol 4 months ago, the average LOS has decreased by 51 minutes and FEV1 measurements are performed 99% of the time. Medication delivery using the BAN is effective allowing some patients to be discharged who would normally be admitted.
**BREATH ACTUATED NEBULIZER IMPROVES QUALITY OF CARE IN PEDIATRIC EMERGENCY DEPARTMENT ASTHMA AND LEADS TO SYSTEM WIDE IMPLEMENTATION**

Bong, C.J.H., Eady, M., Bowman, C.M., Titus, M.O.
Medical University of South Carolina (MUSC), Charleston, SC

*Study Found*
PAS Conference, Baltimore, Maryland 2009

*Synopsis*
The study reports the length of stay, nebulization times, and cost savings findings when using a breath actuated nebulizer (**AeroEclipse® II Breath Actuated Nebulizer, BAN**) versus a conventional continuous nebulizer in a pediatric emergency department.

*Significant Findings*
Approximately 50% fewer patients were admitted to the hospital and an overall reduction in LOS. Patients treated with the BAN spent approximately 33% less time in the Pediatric Emergency Department thus resulting in decreased wait time and a more rapid turnover. One group used 50% less Albuterol per treatment as compared to a conventional continuous nebulizer. Cost savings for the hospital was estimated at $118,000 in labor costs including the cost of device, by reducing each treatment by 5 minutes.

**REDUCTION OF NEBULIZATION TIME, NUMBER OF TREATMENTS AND LENGTH OF STAY CAN BE ACHIEVED WITH A BREATH-ACTUATED NEBULIZER**

Thigpen, K., Simmons, L.
St. Dominic Hospital, Jackson, MS

*Study Found*

*Synopsis*
The study reports findings on nebulization time, average number of treatments per admission and length of stay based on their experience utilizing an updraft nebulizer (UDN) and since their conversion to a breath-actuated nebulizer (Monaghan **AeroEclipse® Breath Actuated Nebulizer, BAN**).

*Significant Finding*
Treatment times were significantly reduced from an average of approximately 10 minutes with the UDN to < 5 minutes with the BAN. The study also demonstrated a reduction in average length of stay (ALOS) for those patients with a primary diagnosis of COPD from 4.81 days with the UDN to 4.41 days with the BAN, a decrease of 0.4 days or 9%. There was a reduction in ALOS for those patients with a secondary diagnosis of COPD from 7.76 days with the UDN to 7.18 days, a decrease of 0.58 days or 8%. Total hospital cost savings were calculated based on the conversion to the BAN. Hospital cost savings for patients with a primary COPD diagnosis were $33,129.60. Hospital cost savings for patients with a secondary diagnosis were $1,929,568.75.

**LEVALBUTEROL 1ML (0.42 MG) Q8H DOSING USING THE AEROECLIPSE® BREATH ACTUATED NEBULIZER**

Pikarsky, R.S., Acevedo, R.A., Farrell, T., Fascia, W.
Crouse Hospital, Syracuse, NY

*Study Found*
Chest 2006 Oct;130(4):182S.

*Synopsis*
In order to maximize therapist time, an auto-conversion from Levalbuterol (Lev) 1.5 ml (0.63 mg) Q8h to Lev 1 ml (0.42 mg) Q8h using the **AeroEclipse® Breath Actuated Nebulizer (BAN)**.

*Significant Finding*
Time to deliver 1 ml by BAN was 2.67 minutes as compared with 8.33 minutes using a standard small volume nebulizer (SVN). The time saved per treatment multiplied by the number of treatments and the hourly Therapist cost annualized to a personnel cost savings of $54,693. The increases cost of BAN vs. SVN annualized to $10,851. Net savings $43,842 per year.

**ONE TIME TREATMENTS WITH THE AEROECLIPSE® BAN IMPROVES CLINICAL ASTHMA SCORE (CAS)**

Sabato, K., Ward, P., Hawk, W. Asselin, J.
Children's Hospital and Research Center at Oakland, Oakland, CA

*Study Found*

*Synopsis*
Children's Hospital and Research Center at Oakland (CHRSCO) Respiratory Care Department conducted a large randomized controlled study comparing the efficacy of a one-time treatment with the **AeroEclipse® breath actuated small volume nebulizer used with mask or mouthpiece, to a one-time treatment with a standard small volume nebulizer or a one-hour continuous treatment for asthmatics presenting to the emergency room.

*Significant Finding*
Use of the Monaghan breath-actuated **AeroEclipse® nebulizer** resulted in significant improvements in Clinical Asthma Scores (CAS) (38% vs 24%, p<0.003), need for admission (31 vs 37, p=0.03) and decrease in respiratory rate (-3.9 vs 0.5, p=0.002) as compared to our standard treatments.
10 CLINICAL AND ECONOMIC IMPACT RESULTING FROM A HOSPITAL-WIDE CONVERSION FROM A SMALL VOLUME NEBULIZER TO THE AEROECLIPSE BREATH ACTUATED NEBULIZERS

Pikarsky, R.S., Acevedo, R.
Crouse Hospital, Syracuse, NY

Study Found
Resp Care 2002 Sept;47(9):1075.

Synopsis
The Respiratory Department converted from the Airlife Misty-neb (SVN) (Allegiance Healthcare Corporation) to the AeroEclipse® Breath Actuated Nebulizer (BAN) (Monaghan Medical Corp., Plattsburgh, NY). This study explores the clinical and economic impact of these interventions.

Significant Finding
Hospital-wide conversion to BAN is cost-effective due to the decrease in administration time. Therapist availability was enhanced, contributing to a significant reduction in omitted treatments. The results show the total number of treatments with estimated time savings of 0.6 full-time employees (FTE) over the 8-month period, or 0.9 FTE annualized ($37,746). The increase cost of the BAN was $4,153. Overall savings was $33,592. The conversion to BAN allows the ability to meet our patient care demands and for the reallocation of workforce needs in a manner that is clinically and economically advantageous.

11 THE CLINICAL EFFICACY OF USING THE AEROECLIPSE® BREATH ACTUATED NEBULIZER (BAN) IN PULMONARY LAB TESTING AND IMPLICATIONS FOR GENERAL USE

Christensen, Y.M., Flanigan, C.J., Ravenscraft, C.J.
Park Nicollet Clinic, St. Louis Park, MN

Study Found
Accepted for presentation at the 47th International Respiratory Congress Meeting, San Antonio, December 1-4, 2001

Synopsis
The purpose of this study is to compare the clinical efficacy and delivery time of nebulization of beta agonist bronchodilator with the use of the AeroEclipse® Breath Actuated Nebulizer (Monaghan Medical Corp.) as compared to the Airlife Misty-Neb Nebulizer (SVN) (Allegiance Healthcare Corporation).

Significant Finding
Substantially shorter test times delivered by the BAN would allow for more tests and associated revenue. Total nebulization time was reduced from 22 minutes (SVN) to 7 minutes (BAN), and total test time was reduced from 30 minutes (SVN) to 15 minutes (BAN). These data support the thesis that the BAN can reduce costs of care by delivering clinically acceptable outcomes in significantly less time.

12 IMPROVING RESOURCE UTILIZATION WITH NEW TECHNOLOGIES

Lewis, M.A., Harris, S.S., Campbell, S.L., Hodges, A.L., Clark, D.M.
Clark DM Baptist Health Medical Center, Little Rock, AR

Study Found
Resp Care 2000 Aug;45(8):981.

Synopsis
This study was to meet patient care needs during the peak respiratory season using Levalbuterol (LEV) (Sepracor In., Marlboro, MA) and AeroEclipse® Breath Actuated Nebulizer (BAN) (Monaghan Medical Corp., Plattsburgh, NY). Both pilot projects were approved by the Respiratory Care Advisory Committee.

Significant Finding
Overtime (OT) hours utilized in 2000 were decreased by 693 hours, resulting in a savings of $16,632, despite the increased number of treatments. The average time per treatment using BANs was 9.9 minutes versus 14.76 minutes with the standard nebulizer. [Due to shorter treatment times] overtime hours decreased by 25% while treatments were delivered to more patients throughout the hospital.

13 CLINICAL EVALUATION OF BREATH ACTUATED SMALL VOLUME NEBULIZER (BAN-SVN)

Klopf, S., Schneiderman, N., Payne, H., Schramm, C., Nagel, M., Mitchell, J.P.
Miami Valley Hospital, Dayton, OH

Study Found
Resp Care 2000 Aug;45(8):979.

Synopsis
This study explored the clinical performance of the AeroEclipse® BAN in the delivery of beta2-agonist (Albuterol 2.5 mg/ml) accompanied by anticholenerigic (Ipratropium bromide 250µg/ml) bronchodilator in some cases.

Significant Finding
Two imminent intubations were avoided with the use of the BAN-SVN. Minimum number of treatments, shorter treatment duration (avg. treatment time 3.97 minutes) and minimal side effects were noticed with this device.

Some of these studies used the AeroEclipse® Breath Actuated Nebulizer, not the AeroEclipse® II Breath Actuated Nebulizer which is currently on the market. The AeroEclipse® BAN and AeroEclipse® II BAN are equivalent in regards to in vitro performance.