

*** This handout is modified from a handout developed by MICHAEL J. WELCH, MD , KETAN K. SHETH, MD and TODD A. MAHR, MD for use at AAP Workshops. Thanks to them for their expertise.**

OUTLINE

I. Introduction

- A. Multiple respiratory devices/gadgets are now available for inhaled therapy for asthma. New delivery systems and gadgets are being introduced often.
- B. Asthma therapy now very technique dependent.
- C. Good technique therefore will dictate good results. Failure of medication response often due to poor technique.
- D. Education regarding these devices must occur in the prescribing office. It's not likely going to occur at the pharmacy.
- E. All office personnel (e.g. MDs, nurses, medical assistants) need to be trained to teach patients about these devices and their proper use.

II. Metered dose inhalers

- A. Major inhaled medication types available:
 - 1. Beta-agonists (short acting, long acting)
 - 2. Cromolyn, nedocromil
 - 3. Corticosteroids
 - 4. Anticholinergics (e.g. ipratropium)
- B. Taste differences:
 - 1. Taste can determine compliance
 - 2. Use of a spacer helps decrease taste problem
 - 3. Practitioners should try to taste all the different medications you are asking your patient to use to appreciate that taste could be a problem .
 - 4. Aerobid and Tilade have taste that can inhibit compliance
- C. The standard MDI:
 - 1. A pressurized metered dose inhaler is simply active medication (powder) plus a gas propellant as a mixture in a canister with an actuator device.
 - 2. Practical aspects of the MDI:
 - a) The canister needs to be shaken (not stirred) before using each time (the medication is a gaseous suspension).
 - b) The canister unit needs to be right side up. Gravity is needed to fill the chamber that holds the next dose.
 - c) Priming with a new unit needs to be done (exception: HFA); also with a unit

- that has not been used in awhile (e.g. weeks).
- a) More than one “hit” or puff of an inhaled medication is advised since the first puff can often have less than the expected amount of medication due to leakage loss while the MDI unit is sitting around in between doses.
 - d) MDI canisters can grossly be assessed as to how full they are by putting them (without plastic holder) in a bowl of water and seeing if they float horizontally at the top (empty), sink to the bottom (full) or float halfway between top and bottom (half-full). This does not work for all MDI medications (e.g. Intal/Tilade).
3. Teaching patients - general comments:
- a) Education should be done in your office when patient starts on inhaler.
 - b) Periodic checks of technique need to occur on follow-up visits.
 - c) Use samples or placebo inhalers for demonstration. Actually have the patient do a dose in the office and give feedback. Don’t just explain verbally and have the patient leave. Have them use the inhaler in front of you.
 - d) Alternatively, give pharmacy clear instructions to explain how to use the MDI. Write this on the prescription. This is not ideal; it is better to do it yourself (or your staff) in the office.
4. There are 2 techniques for using an MDI without spacer - **open** and **closed-mouth**:
- a) How to teach a patient to use the **closed-mouth** technique:
 - (1) Tell patient to shake the MDI.
 - (2) Have patient practice squirting the inhaler in the air a couple of times to get the proper feel of activation.
 - (3) Patient should be preferably in the standing position.
 - (4) Tell patient to put the MDI "through the teeth and tongue underneath." Make sure the MDI is through the teeth and the tongue is underneath and away from the inhaler opening.
 - (5) Tell patient to "relax, drop your shoulders."
 - (6) A cleansing breath is not needed; I suggest do not use. Can be confusing for young children.
 - (7) Tell patient "push down on the canister at the same time you suck in deeply - not too fast, not too slow."
 - (8) Tell patient "at the top end of your deep breath, hold it for at least 10 seconds."
 - (9) After the first "hit," have patient wait for a few seconds, and then repeat.
 - (10) Observe the patient in the office when taking the inhaler for the following mistakes/problems:
 - (a) Mist coming up through the canister [(the “chimney sign” it usually means either obstruction (tongue, teeth), or inhalation occurred too late after activation)].
 - (b) Mist coming out patient's mouth (“Binaca breath” technique-usually means that the patient did not inhale adequately after activation).
 - (c) Too early/late MDI activation
 - (d) Too fast/slow inhalation
 - (e) Not a full inspiration (“80%” method)
 - (f) Nasal instead of oral breathing
 - (g) Too short of breath hold
 - b) How to use **open-mouth** technique:
 - (1) Hold MDI a few inches from wide-open mouth and direct toward mouth.
 - (2) Make sure mouth is widely open.

- (3) Do everything else the same as above with **closed-mouth** technique.
 - (4) Make sure medication makes it into the mouth.
 - (5) Problems with **open-mouth** technique:
 - (a) Spray is angled wrong and misses mouth.
 - (b) Mouth not open wide enough.
 - (c) Breath not taken at same time as inhaler activated.
 - (6) Spacer device use is preferred over **open-mouth** technique (my opinion).
5. I repeat: check inhaler technique when the patient comes to the office at follow-up visits.

- D. Alternative MDI device: Maxair Autohaler
- 1. Aerosol device where unit fires automatically on inspiration.
 - 2. Useful in that coordination of inhalation and activation of MDI not necessary.
 - 3. Canister unit holds 400 doses (higher than regular MDI canister).
 - 4. Active drug is pirbuterol - a beta agonist with pharmacologic and pharmacokinetic properties identical to albuterol (some people report less jitters with pirbuterol.)
 - 5. The "puff" is very soft - patients often report that they can't perceive they received a dose.

I. III. Spacer devices (general, 5 yrs and older)

- A. Multiple ones available (Inspirease, Aerochamber, Aerochamber with mask, EZ Spacer, EZ Spacer with mask, Optihaler, Optihaler with mask, ACE, MicroSpacer, Mist-Assist, Dixie-Cup, EasiVent, Ellipse, Volumatic, etc.)
- B. A spacer provides the following advantages:
 - 1. Slows up aerosol particle speed before entering the mouth (allows more medication delivered to the lungs).
 - 2. Decreases amount of medication impacting on oropharynx (less medication in mouth and medication swallowed).
 - 3. Helps patients use an MDI when they are not able to coordinate actuation with inhalation very well.
 - 4. Can help control rate of inspiration to one of an optimal speed.
 - 5. Reduces "bad taste" of medication.
- C. The optimal spacer device for adults is large in volume (750 ml) and pear-shaped (e.g. Volumatic). The ones we use are smaller and more practical (e.g. Aerochamber). However, for children, especially small children, the large volume spacers can pose a problem in terms of dead space. Therefore, large volume is not necessarily better.
- D. Spacers, especially the "bag" type, (e.g. Inspirease, EZ spacer) can give children as young as 3 and 4 years of age the chance to use an MDI, with fairly good drug delivery. Tube spacers with mask (e.g. Aerochamber with mask) allow one to treat even infants and young toddlers with MDI medication.
- E. Personal biases:
 - 1. Learn one or two spacers and be comfortable using those ones.
 - 2. Ask your pharmaceutical reps to give spacers to your office (they have become give-aways for many companies)
 - 3. Spacer with mask can be effective for infants and young children but it requires a lot of parent education. It should not automatically substitute for the family getting a

nebulizer unit.

4. Not everyone, every inhaler medication, needs a spacer (e.g. adults with good MDI technique, using beta-agonists, don't have to use spacers), but it helps to have one.
 5. Spacers should be used routinely for inhaled steroids (exception: budesonide [Pulmicort] powder; fluticasone [Flovent] powder, ADVAIR).
 6. Major items accomplished with spacers:
 - a) Reduce oral impaction and therefore, drug "eaten."
 - b) Allow certain patients to use an MDI who otherwise could not
 - c) Decrease bad taste
 - d) Better lung delivery
 7. Yes, spacers allow for better lung delivery, but not that much more when compared with good MDI technique without spacer.
 8. Realize that many insurance companies will NOT pay for a spacer, therefore patients may be unwilling to pay \$35-50 out of pocket. This may be a limitation of spacer use. Either ask the patient of dispense one free (often given by pharmaceutical companies) or dispense one at cost.
- F. Education regarding proper spacer use in office:
1. Have spacer device in office to show patient and family.
 2. Use same careful in-office instructions as with education regarding MDI without spacer (see above).
 3. One potential problem with use of the spacer: time between canister activation and patient inhalation is too long. This time should not exceed 1 – 2 seconds.
 4. Therefore, make sure patient has spacer in his/her mouth ready to inhale as soon as canister is pushed.
 5. Do not have patient use multiple "hits" into the spacer at one time.
 6. Check technique every time the patient comes to the office.
 7. Wash spacer in weak dishwasher soap solution and dry well to keep clean approximately every week. The patient should ideally have two spacers to be able to use one while the other is drying.
 8. Washing with a mild soap helps reduce electrostatic charge on the plastic walls of the spacer. Reducing charge helps decrease medication adhering to the spacer, and increases medication delivered to the patient.

IV. Spacer/MDI in infants/toddlers

- A. General
1. Many countries (e.g. Canada) rarely use a nebulizer machine, even for young children.
 2. Considerable literature exists showing the MDI/spacer system in adults can substitute for the nebulizer, even with significant acute exacerbations. Recent pediatric studies also show comparisons of "high dose" MDI vs. nebulizer treatments.
 3. Available spacers/masks through out the world:
 - a) Aerochamber with mask (2 sizes of facial masks – small (neonatal/infant), and medium). (150 ml) (Monaghan)
 - b) Easivent with mask (DEY) (250 ml)
 - c) EZ spacer with mask (DURA)
 - d) Vortex w/Mask (PARI)
 - e) Pocket Chamber w/Panda Mask (FERRARIS)
 - f) Nebuhaler with mask (750 ml) (Astra)
 - g) Babyhaler (350 ml) (Glaxo)
 - h) Nebuchamber (metal) (300 ml) (Astra)
 4. Note that the various spacers have different volumes. All are made of plastic,

- except for the Nebuchamber (metal).
5. Not all of the above spacers are available in the USA (Nebuhaler, Babyhaler, and Nebuchamber are not – only found in Europe and some other countries).
 6. Aerochamber with mask, of all the spacers, has been studied the most in children of all ages, has an effective one-way valve system that works at low flow rates, has a low total volume, and could be considered the preferred spacer with mask for young children (at least of the ones available in this country).
 7. In picking a spacer device/system, or a nebulizer device/system, one has to be aware that the issue of inhalation therapy, for all age groups, is complex.
 - a) Conclusions from studies with one drug delivered from one inhaler and spacer system (or nebulizer) may differ from conclusions from another drug used in the same system.
 - b) Conclusions from adult studies may not be transferable to children.
 - c) The new CFC-free MDI's have very different properties and output characteristics as compared with present CFC inhalers,
 - d) Every child is unique, and may require one system over another because of their specific abilities, temperaments, and willingness to cooperate.
 8. Realize that although numerous studies have shown that the MDI/spacer system can be effective in even young children, and obviate the need and “hassle” of a nebulizer machine, plenty of mistakes are made in the “real world” by patients/families with use of the MDI/spacer/mask .
- B. Practical aspects of use of spacer with mask in young children.
1. In office training of the caregiver is essential! Don't rely on the pharmacy.
 2. Make sure the right mask size is ordered for the child. For example, the Aerochamber with mask has 2 sizes of mask. Too often, the small infant is given by the pharmacy the child-sized mask, or worse, the toddler is given the infant size mask. The mask should just barely fit around the imaginary “ring” formed by the top of the nose, and the outer corners of the mouth. Have the parent bring their device in to the office at a follow up visit to make sure they were given the correct device.
 3. Plastic spacers should be washed initially after purchase and then weekly with a mild detergent/water to help reduce static charge that binds to medication. Not doing this may result in as much as 50 – 70% of drug being absorbed by the sides of the spacer, and therefore, not delivered to the patient.
 4. Only one actuation of the aerosol medication at a time should be done. The largest dose of the medication will occur with the first inspiration. Continued tidal volume breathing will deliver more medication but it quickly tapers off.
 5. A tight seal around the child's face with the mask should occur for about 20 seconds, or 5 to 6 breaths, if possible.
 6. Some parents accomplish giving their child inhaled medication by MDI with spacer/mask by laying the child on the floor, sitting on the top of the child with the child through their legs, and holding the spacer and mask on the child's face oriented vertically.
 7. There should not be a significant lag time between the actuation of the aerosol medication, and the first breath of the child. Everything needs to be in place, and ready to go before the MDI is fired. A significant decrease can occur within 1 second, the amount of trail-off dependent on the volume of the spacer (the larger the volume, the less dissipation over time). Data on the Aerochamber shows about a 30% decrease in available medication after 1 second.

V. Alternative hand-held medication delivery devices

- A. Maxair Autohaler: Useful in that coordination of activation and inhalation not necessary (see above).
- B. Multi-dose powder devices: Three devices are now available (Diskhaler, Diskus, Turbuhaler). The technique for these is fairly simple and has a number of advantages over the pressurized MDI. Most important advantage: coordination of actuation with inhalation not needed like it is with a pressurized MDI.
 - 1. DEVICE= Diskhaler,
 - a) MEDICATION= Flovent or fluticasone (corticosteroid). Comes in 3 strengths (50 mcg, 100 mcg, 250cg per puff) in a disc (Rotadisks) with unit doses of 4 doses per disc. Disc fits in a powder delivery device. A little more “cumbersome” of a device than other two.
 - b) MEDICATION= Relenza - inhaled treatment for influenza.
 - 2. DEVICE= Diskus. Very easy to use delivery device. Dose counter on device so patient knows exactly how many doses are left. Future delivery system of many medications in the next few years.
 - a) MEDICATION = Serevent or salmeterol, a 12 hour long acting beta-agonist.. One puff of powder equal to 2 hits of MDI. Powder has a lactose filler - dose is therefore perceived/tasted. Color = Teal/Green
 - b) MEDICATION= Flovent or fluticasone (corticosteroid). Comes in 3 strengths (50 mcg, 100 mcg, 250mcg per puff). ? Available? Color = Orange
 - c) MEDICATION= Advair = fluticasone and salmeterol. Comes in 3 strengths (Advair 100, 250, 500, refers to amount of fluticasone per puff, salmeterol strength is 50 mcg/puff). Color = Purple.
 - 3. DEVICE = Turbuhaler -
 - a) MEDICATION= Pulmicort or budesonide (corticosteroid), 200 mcg/puff. Technique is easy. Inspiratory effort must be adequate. A trainer whistle is available. Device is moisture sensitive. “Out of drug” warning window warns when 20 doses are left. Patient usually does not perceive the dose. Which is an advantage or disadvantage depending on the patient

II. VI. Nebulizer therapy

- A. Another type of delivery system for inhaled asthma medication is nebulization.
- B. Advantages:
 - 1. Can be done by young children who cannot use MDI.
 - 2. Delivers a high dose of medication slowly.
 - 3. Wet therapy may have some benefit over dry aerosol (e.g., MDI).
 - 4. Delivers medication over a prolonged period of time in a semi-passive way.
 - 5. Parents are more comfortable that the child is getting the medication.
- C. Nebulization therapy for delivery of beta-agonists may not be any more effective than MDI therapy assuming good cooperation and technique with the MDI.
- D. Have a low "threshold" to get a family of a child with asthma a nebulizer for home. It can go a long ways in keeping the child out of the ER and hospital. Saving one ER visit (often \$1,000 to \$1,500) pays for the cost of the machine (\$150 -\$200).
- E. Two types of nebulization: jet versus ultrasonic
 - 1. Jet: most common type, less expensive; usually adequate

2. Ultrasonic: finer particle size, quieter, can be very portable (see below). Nebulizes dose fully - no residual liquid. Often quicker i.e. 2-3 minutes, uncertain if this is an advantage if the child is not cooperative and moving about- will they miss too much of the dose.
 3. Probably no big clinical difference between ultrasonic and jet nebulization. One problem with ultrasonic nebulizers: they are used mainly with a mouthpiece; facial masks for use in children not readily available.
 4. There are moderate differences in particle size, distribution and nebulization rate between different jet nebulizers (e.g. Devilbiss, Pari-Jet, etc.).
- F. Three ways to have patient breathe nebulized mist:
1. Mouthpiece
 2. Mask
 3. "Blowby" (used for young children). Try to avoid - not very effective.
- G. Tips for effective nebulization:
1. Albuterol volume: 0.5-1.0ml with 1.5 to 2.5cc saline.
 2. Try to have patient use mouthpiece over mask; in young children, use mask (or mouth piece) over blowby, if able to.
 3. When using the mouthpiece, consider occluding nose during nebulization therapy, if necessary to avoid nasal breathing. Can use a nose clip or just have patient pinch nose.
 4. Consider a "thumb valve" in the air tubing system to allow for decreased aerosol wastage.
 5. Proper coaching is essential (e.g. deep, not rapid, breaths).
 6. Take occasional rests during treatment (i.e. turn machine off or use thumb valve).
 7. Typical treatment time: 7-15 minutes
 8. If necessary during the treatment, parent or caretaker can read book to child, watch TV together or watch a video.
 9. Try to make the nebulization experience positive every time, and not negative.
 10. Maintaining nebulizer/compressor:
 - a) Wash nebulizer bowl with diluted soap and water every few days if used regularly. (Periodically, use vinegar to remove hard water deposits).
 - b) It is a good idea to have 2 nebulizer bowls to alternate.
 - c) Change compressor filters every few months if used often.
- H. All offices should have at least one nebulizer for use in office for children with acute asthma; should also have a "loaner" machine to lend to patients for short-term use at home.
- I. Portable nebulizers:
1. Many patients/families travel, camp, etc. and desire portable nebulizer units.
 2. Portable units available that run off battery, or plug into car cigarette lighter. These can be fairly expensive (\$600-800) and are often not covered by insurance or as a second unit. Regular, non-portable nebulizers can be made portable by having patient purchase a cigarette lighter adapter for the car (Radio Shack) to plug in conventional nebulizer.
 3. Various portable units available:
 - a) Micro-Air (Omron)
 - b) DuraNeb 1000, 2000 (Dura)
 - c) Pulmo-Aide Traveler (DeVilbiss)
 - d) Pari Walkhaler (Pari)
 - e) Pulmo-Sonic Ultrasonic (DeVilbis)
 - f) Medox Champion Compact Nebulizer (Ultrasonic)
 - g) And others.
- J. Differences between jet nebulizers.

1. Nebulizer devices can present significantly different qualities of medication to patients depending on their intrinsic design characteristics, flow rate, and the patient's breathing pattern.
2. In one study (Smaldone, et al, 1998) 27 nebulizer/compressor combinations were evaluated for their "inhaled mass" (total quality of drug delivered to the patient mouthpiece) of budesonide inhalation suspension and a "respirable mass" (particles less than 6.0 micros in diameter) The inhaled mass varied from 2% - 18% of the original amount placed in the nebulizer, depending on the nebulizer system used. The Pari LC – Jet Plus/Pari Master system delivered the highest inhaled and respirable mass.

VII. Peak Flow Meters (PFM)

- A. PFM device is helpful in quantitating how well or poorly a child is doing in terms of asthma.
- B. PFM's are an important part of the NHLBI guidelines/recommendations for treatment of asthma. Recent guidelines suggest once-a-day PF checks in the AM.
- C. PFM not for every asthmatic patient. For example, patients with intermittent asthma, or mild persistent asthma, don't necessarily need.
- D. Children age 5 years and up can usually perform an adequate PFM maneuver.
- E. Numerous kinds/brands: Mini-Wright, Assess, Personal Best, PocketPeak, True Zone, Astech, Peak, Health Scan, Asmalert, and others.
- F. Accuracy of PFM not as important as reproducibility.
- G. Ranges for some of the PFM's: normal and low. If age less than 7 or 8, low range necessary.
- H. Proper in-office instruction necessary
 1. Demonstrate/explain in person, in office.
 2. To do a PFM maneuver, have patient blow hard and fast. Make sure there is a tight seal around the mouthpiece. Repeat, at least, x 2; take best reading of 3.
 3. Make sure patient is not "flicking" the device downward with his head which will make it register too high.
 4. Other forms of "cheating" is when the patient coughs or does a Valsalva maneuver. This can falsely elevate reading.
- I. Explain the green/yellow/red zone to family/patient.
 1. Emphasize to the patient the need to discover the "personal best" when patient is doing well.
 2. The patient should have an "asthma action plan" to go with the PF.
- J. Computerized PFM systems with a modem are now available (e.g., Airwatch, SmartMist).
 1. Allows the patient to maintain a computerized record of his/her PFM readings.
 2. The treating physician can receive a regular record of how a patient is doing in terms of PF readings.

9.

PEAK FLOW METER (PFM) STATION

1. Point out all the PFM's – lots!!
2. Point out some of PFM's come in two "sizes" (e.g. MiniWright):

- a. Low range (up to age 7 – 8 years)
 - b. High range (> age 8 years)
3. Patient needs to do proper technique:
- a. Don't cough into it
 - b. Maximal effort
 - c. Need to generate consistent values; Then, take best of at least 3 efforts.
4. Go over when is best time of day to do:
- a. Ideal – AM and PM (pre/post inhalers). Can settle for just AM (1997 NAEP Guidelines).
 - b. Any time there is a significant asthma flare to document how severe the episode is.
 - c. When the patient is doing real well to get a personal best.
 - d. When the patient is developing a “cold” to see if asthma is being triggered.
5. Go over ZONES:
- a. “GREEN” – “cruisin”; no intervention
 - b. “YELLOW” – use beta-agonist to get in green zone. Remember to be real compliant/consistent with prevention meds. Make sure patient is doing proper inhaler technique.
 - c. “RED” – Act quickly, aggressively to get out of red zone into yellow or green. Use beta-agonist (e.g. nebulizer) at a good dose. If unable to get out of red, immediately call MD of see MD. If often in red, see MD soon.
6. Patient should keep record (chart) of PF readings at home; can be part of a medication and symptoms diary. Bring chart with patient to MD's office for his/her visit.
7. Point out coverage by insurance companies is generally poor (i.e., not covered). Can get coverage as a DME but often requires special paperwork. Try to get free PFMs from pharmaceutical companies to give to patients.
8. Point out AirWatch System:
- a. Measures FEV₁ and peak flow
 - b. Downloads information onto computer via phone (internal modem)
 - c. Provides graphic summary to prescribing MD.
 - d. Cost: Initial year – approx. \$150.00
 Subsequent years – approx. \$100.00

MDI STATION

1. General comments to be made:
 - a. Educate patients in office – don't rely on pharmacy or enclosed directions.
 - b. Use samples, if available.
 - c. Train your nurses to be able to train patients.
 - d. Check MDI technique **every time** the patient comes to the office.
 - e. Not every patient/every MDI needs a spacer. Reasons for spacer:
 - (1) Inhaled steroids
 - (2) Young children, older adults
 - (3) Taste [(e.g. nedocromil (Tilade), flunisolide (Aerobid))]
 - (4) Technique difficulties
 - f. Realize drug delivery to lungs is approximately 10%-15% without spacer, 15%-20% with spacer.

2. Point out two methods of MDI use without spacer:
 - a. Open-mouth
 - b. Close-mouthDemonstrate the difference between the two.
[I prefer the closed mouth technique with children]

3. Point out six basic steps; **Essential**:
 - a. Body position/relaxation
 - b. Shake canister
 - c. Proper positioning in mouth (“Through the teeth, tongue underneath”)
 - d. Activation properly coordinated with inhalation
 - e. Proper inspiratory flow rate
 - f. Adequate breath hold

4. Have all participants demonstrate proper use using their placebo inhaler. Give feedback on their technique.

5. Point out mouth rinse important for all inhaled steroids, and for any MDI that leaves a bad taste (for better patient acceptance).

6. Point out Proventil HFA, and how it has some different properties than the regular albuterol MDI (plume, shaking, taste).

7. Demonstrate Maxair Autohaler:
 - a. Point out how actuation is automatic
 - b. Use Maxair Autohaler placebo; demonstrate
 - c. Have participants use Maxair Autohaler placebo; give feedback.

DPI STATION

1. Demonstrate powder delivery system:
 - a. Three available now:
 - (1) Diskus (Serevent, Flovent, Advair)
 - (2) Diskhaler (Flovent)
 - (3) Turbuhaler (Pulmicort)
 - b. Show how each works.
 - c. Point out how:
 - (1) Diskhaler uses single-dose blister pack units.
 - (2) Pulmicort is a non-blister, multi-dose reservoir device.
 - d. Powder devices have dose indicators (Diskus, Pulmicort).

- e. Demonstrate Turbuhaler trainer (whistle).
- f. Patient can't perceive dose with Pulmicort Turbuhaler (there is no filler powder). Powder dose can be perceived with Diskus due to lactose filler.
- g. Moisture can be a problem with powder device – keep cap on (Pulmicort) or device closed (Diskhaler).
- h. Use placebos, demonstrator devices and have workshop participants use the powder devices.

SPACER STATION

1. Point out **all** the spacers available – lots!!
2. Reasons to use spacers – Remember the 4 “T’s”
 - a. Tots
 - b. Taste
 - c. Technique
 - d. “sTeroids”
3. Beta-agonists may/may not need a spacer.
4. Younger kids should use a bag type; older kids a chamber type.
5. Can teach some 3 year olds to use an MDI with bag spacer – usual age: 4 – 5 years is youngest. Don't allow an older child or adult to continue using a closed bag system (e.g. Inspirease) since it limits his/her inspiratory volume. Graduate that patient to a tube spacer.
6. Aerochamber with mask – can be used for the young child, but the family may still need to have a nebulizer.
7. Don't wait long time (e.g. > 1 second) after actuating MDI to have child inhale.
8. Ten second breath hold important.
9. Don't squirt more than one puff in to chamber each time it is used. Use 1 “hit” with 1 inhalation.
10. Inspirease bags don't need to be replaced ever 1 – 2 weeks as it states in the insert. Replace when it has a hole, or appears “grungy”. Should be cleaned with warm soap and water. Dry well. Have 2 bags, rotating each with one bag always drying out.
11. The “whistle” on the Aerochamber is set quite “low” in terms of flow rate. Even with good technique, the “whistle” goes off slightly.
12. Discuss electrostatic charge, and how the charge on the spacer wall can bind medication and reduce amount delivered to the patient. Washing with mild detergent can help decrease this charge.
13. Powder medications/devices are **not** to be used with spacers.