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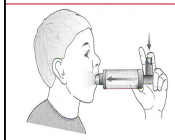

MDI DEVICES & NEBULIZERS TECHNIQUES, PRIMING & CARE

Lisa Romard, MS, RN, CPNP, ANP, AE-C

Disclosures:

- This presentation and clinical recommendations support "best available evidence" from medical literature.
- I refrain from making recommendations regarding products or services.
- I have no financial relationship requiring divesting.
- I have associations or memberships with the following organizations
  - Stony Brook University Hospital
  - Association of Asthma Educators
  - National Association of Pediatric Nurse Practitioners
  - Asthma Coalition of Long Island

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CONTENT & GRAPHICS

- CONTENT & GRAPHICS FOR THIS PRESENTATION HAVE BEEN ADAPTED FROM VARIOUS LECTURES, POWER POINT PRESENTATIONS I HAVE GIVEN THROUGH MY POSITION @ STONY BROOK UNIVERSITY HOSPITAL, AND THE ASTHMA COALITION OF LI
- Good resource : American Association for Respiratory Care Guide to Aerosol Delivery Devices
- https://www.aarc.org/resources/aerosol_nonrts.pdf

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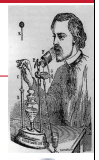
THE EVOLUTION OF INHALATION DEVICES

- Centuries ago: Fumagations, steam, inhalants such as herbs
- Many asthmatics continued to smoke asthma cigarettes, inscents, or other palliative asthma remedies.
- 1700's 1st patented inhaler, 1800's 1st patented nebulizer
- Pressurized MDI & Electric nebulizers 1950's



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HISTORY OF THE NEBULIZER

- The term "nebulizer" derives from the Latin "nebula," meaning "mist," and reportedly was first used in 1872, followed by an 1874 definition as "an instrument for converting a liquid into a fine spray, especially for medical purposes." vapor or aerosol for the inhalation treatment of lung disease is at least as old as written records of medicine.
- The Ayurvedic (traditional Hindu **medicine**) tradition of medicine in India, which dates back perhaps 4,000 years or more, used inhaled substances for managing asthma.
- The intitial devices appeared with the glass and hand-bulb "atomizers" introduced for asthma treatment in the 1930s, such as the:
- DeVilbiss No. 40 glass nebulizer.
- The Collison nebulizer became available in the late 1940s; it used a baffle to filter out large particles, thus distinguishing a "nebulizer" from an "atomizer."
- The Wright nebulizer, which appeared in the 1950s, was engineered from ebonite and perspex; it was much more compact than the Collison and more closely resembled today's pneumatically powered nebulizers.

- The -modern small-volume nebulizer -Inhalation medication devices described for patient care use in the 19th century

- The ultrasonic nebulizer, a different method of creating liquid aerosols was introduced in the 1960s.

- Nebulizer designs have been modified for consumer satisfaction : effectiveness, ease of use, convenience, appeal of machine (children's models), cost, etc.

- Despite many studies, the debate of the nebulizer as a preferred delivery system for inhaled medications goes on. Many variables cause the study findings to be up for discussion.
  Patient satisfaction, cost, provider preference, patient acceptance & education are some factors for choice of device

http://www.rcjournal.com/contents/11.02/11.02.1257.cfm

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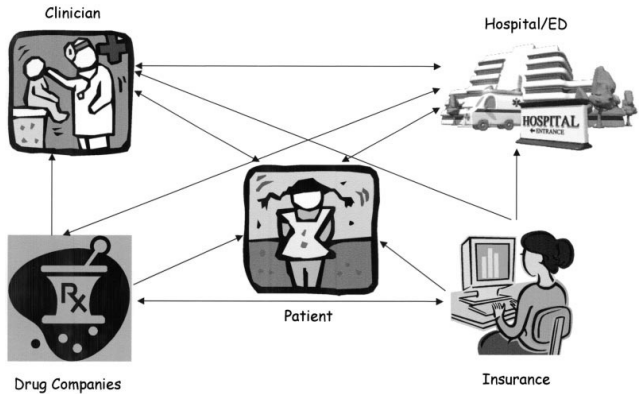
INTERACTIONS THAT GUIDE THE CHOICE OF AEROSOL DEVICE.



Accessed 6/1/15: COMPARING CLINICAL FEATURES OF THE NEBULIZER, MDI, AND DPIhttp://www.neumologica.org/POSTGRADO%202008/Articulos%20Virtuales%20Aerosolterapia/Aerosolterapia%20AARC%202005/Comparing%20Clinical%20Features%20of%20the%20Nebulizer..pdf

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MDI- METERED DOSE INHALER

- Medication in a pressurized canister, medication mixed with propellant now CFC free (HFA) due to concern for Ozone effects of CFC's in aerosols
- Store at room temperature
- Priming: In general a new MDI out of the box or not used for a few days to 2 weeks, and some if dropped need 3-4 sprays to prime
- Keep cap on mouthpiece to avoid FB collecting in MP
- Technique requires slow & steady active/co-ordinated dosing and inspiration, & ability to follow specific instructions (usually ages 12yo & up) Spacers may be used to improve medication delivery
- Many have dose counters- Do not float canister in water
- **When the counter reads 000, throw the inhaler away.** You should not keep using the inhaler when the counter reads 000 because you will not receive the right amount of medicine.

Source: http://rc.rcjournal.com/content/50/9/1177.full.pdf

Priming & cleaning resource tables :
http://www.pamf.org/asthma/medications/n1062%20HFA%20Inhaler%20HO.pdf

http://www.nationaljewish.org/healthinfo/medications/lung-diseases/devices/metered-dose/hfa-propellant/#5

http://nebula.wsimg.com/4c910200f7a2cd848e75769f64d6d0c8?AccessKeyId=32029651ABFAD3DBF315&disposition=0&alloworigin=1

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ACCESSED : 6/1/15 HTTPS://C.AARC.ORG/EDUCATION/AEROSOL_DEVICES/

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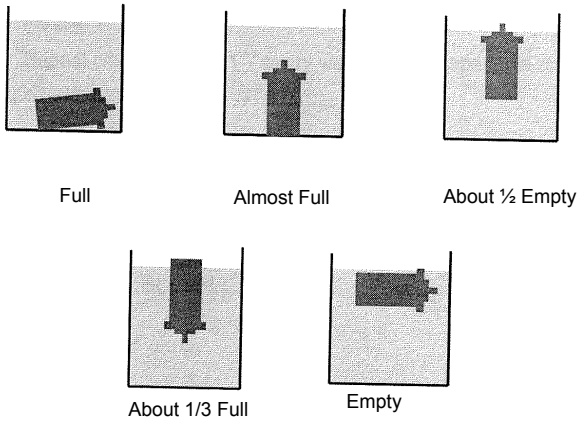
OLD WAY TO TEACH HOW TO CHECKING HOW MUCH MEDICATION IS LEFT IN THE CANISTER



http://evans.amedd.army.mil/Peds/PDF/Use%20of%20an%20MDI%20and%20Spacer.pdf

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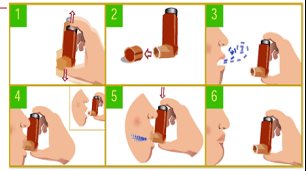
- Each inhaler needs to be cleaned to prevent build-up and blockage. MDI inhalers need special care in order to make sure that they work properly and deliver the correct amount of medicine
- 1 remove the plastic mouthpiece cap
- 2 remove the metal canister (don't put it in water)
- 3 rinse the mouthpiece and cap under warm water
- for at least 30 seconds
- 4 shake off any excess water and dry the
- mouthpiece and cap thoroughly
- 5 put the metal canister back in, and replace cap.
- Check the manufacturers' instructions for any special instructions for your type of inhaler.

Stony Brook Children's VISUAL EDUCATIONAL TOOLS FOR HOME/OFFICE

- EXAMPLES:
- CHEST RESOURCES :
  http://use-inhalers.com
- http://use-inhalers.com/learn-quick-video-mdi-with-spacer
- American lung association: www.lung.org- How to use asthma medicines U-tube videos: https://www.youtube.com/playlist?list=PL2E0F4A3784937A7F
- Asthma APPS-**Assist Me with Inhalers**
  https://itunes.apple.com/us/app/assist-me-with-inhalers/id590417707?mt=8

Stony Brook Children's **HOW TO USE A METERED DOSE INHALER**



(Accessed 6/16/14 @http://use-inhalers.com/what-is-an-inhaler-dose)

- Remove the cap-inspect the MP for foreign bodies
- Shake the inhaler to mix the medication w/ propellant
- Prime the inhaler as per the manufacturer guidelines
- Breathe out a normal breath, Tilt head back slightly
- Position mouthpiece:
- A) Closed-mouth technique-MP in mouth w/ it under tongue,
- lips sealed around MP
- B) Open-mouth technique-3 fingers away from & parallel to mouth,
- with the mouth open wide & inhaler mouthpiece horizontal to mouth
- Breathe in slowly and deeply. About 1/3 way into the inspiration phase, depress canister and continue to inhale until maximal inspiration is meet. ** do not stop the steady flow of inspiration, no stopping or pausing**
- Hold breath for 10 seconds (or as long as possible)
- Breathe out slowly through nose

http://www.cdc.gov/asthma/inhaler_video/default.htm

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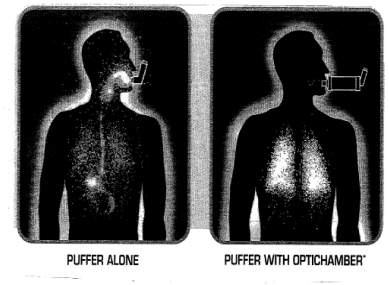

http://www.spiropharma.dk/uploads/Optichamber_brochure.pdf

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ADVANTAGES AND DISADVANTAGES OF HOLDING CHAMBERS OR SPACERS ("ADD-ON" DEVICES) USED WITH MDI'S

Advantages	Disadvantages
• Reduced oropharyngeal drug impaction and loss	Large and cumbersome compared to the MDI
• Increased inhaled drug by two to four times than the MDI alone	More expensive and bulky than a MDI
• Allows use of the MDI during acute airflow obstruction with dyspnea	Some assembly may be needed
• No drug preparation required	Patient errors in firing multiple puffs into chamber prior to inhaling or there is a delay between actuation and inhalation
• Simplifies coordination of MDI actuation and inhalation	Possible contamination with inadequate cleaning

Accessed 6/11/5: https://c.aarc.org/resources/aerosol_resources/aerosol_guide_frt.pd

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SPACERS AND HOLDING CHAMBERS

- Can be used with or without a mask
- Can be used by all ages
- Can improve medication deposition in the lungs vs MDI alone.

http://www.cdc.gov/asthma/inhaler_video/default.htm

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MDI WITH A SPACER INSTRUCTION SHEETS

Accessed 4/24/205 http://www.pamf.org/asthma/education/handouts/Asthma_Inhaler_Spacer.pdf

Resources: GINA HANDOUTS: http://www.ginasthma.org/inhalers/12

American lung association: www.lung.org- How to use asthma medicines U-tube videos: https://www.youtube.com/playlist?list=PL2E0F4A3784937A7F

CHEST: http://www.med.umich.edu/1info/FHP/practiceguides/asthma/various.pdf

NIH: http://www.nhlbi.nih.gov/health/public/lung/asthma/asthma_tipsheets.pdf

CDC: http://www.cdc.gov/asthma/pdfs/Inhaler_Spacer_FactSheet.pdf

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MDI AND SPACER WITH MASK

Take cap off MDI. Check for and remove any dust, lint, or other objects. Shake MDI well.

Attach MDI to spacer.

Have the child sit up straight or stand. Place the mask over the child's nose and mouth. The mask should be held on the face firmly enough so none of the medicine can escape.

Press down on the MDI. This puts one puff of medicine in the spacer.

To breathe in that one puff of medicine, the child should **BREATHE IN AND OUT NORMALLY FOR SIX BREATHS.** Do not remove the mask until the sixth breath is complete.

Remove the mask from the child's face.

If your child needs to take another puff of medicine, wait 1 minute. After 1 minute repeat steps 3-6.

CHEST: http://www.med.umich.edu/1info/FHP/practiceguides/asthma/various.pdf

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CLEANING MDI AND SPACER

Cleaning Your MDI

Take metal canister out of plastic container. | Rinse plastic container with warm water at least once a week. | Let plastic container air dry. | Replace metal canister in plastic container.

Cleaning Your Spacer

Remove rubber end where MDI fits. | Fill a sink or deep bowl with warm water. Add one drop of liquid detergent. | Place both pieces in the warm soapy water, and gently shake both pieces back and forth. | Rinse only the mouthpiece in running water.

Shake to remove the water. | Let air dry in vertical position. Do not dry with towels. | Put rubber end back on spacer when completely dry.

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Principles of Liquid Nebulization

Liquid nebulization is a common method of medical aerosol generation. Nebulizers are of 2 types: jet (or pneumatic) small-volume nebulizer, and ultrasonic nebulizer.
The physical characterization of both the jet and ultrasonic nebulizers, demonstrated that particle sizes of both systems are within a range suitable for airway deposition **(http://www.rcjournal.com/contents/11.02/11.02.1257.cfm)**

TYPE	Converting a liquid into a fine mist	ADVANATGES	DISADVANTAGES
Jet Nebulizers most common type	Venturi principle- Design causes a increase in the velocity of flow of a fluid	• Durable & reliable • requires only simple, tidal breathing, • Effective for liquids & solutions	• length of treatment time • equipment size • + residual fluid at completion not as efficient at nebulizing every last drop of medication
Ultrasonic Nebulizers	Piezoelectric effect convert alternating current to high-frequency acoustic energy Ultrasonic nebulizers use a transducer to convert electrical energy to high-frequency ultrasonic vibrations. These vibrations are transferred to the surface of the medication solution that is placed over the transducer, generating an aerosol.	• Higher output rate shorter delivery time • Quiet • Light weight • smaller in scale handheld models • Portable • Minimal residual fluid at completion	• larger average particle size • more expensive and fragile • may heat the liquid & cause drug degradation, • does not nebulize suspensions well

http://medical-dictionary.thefreedictionary.com/ultrasonic+nebulizer
http://www.nlm.nih.gov/medlineplus/ency/patientinstructions/000006.htm

Use Budesonide Inhalation Suspension with a jet nebulizer connected to an air compressor set up with a mouthpiece or face mask. Do not use an ultrasonic nebulizer to give Budesonide Inhalation Suspension.

http://www.drugs.com/pro/budesonide-inhalation-suspension.html

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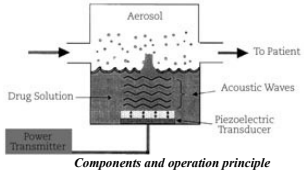
ULTRA SONIC NEBULIZER

Ultrasonic nebulizers convert electrical energy to high-frequency vibrations using a transducer.
These vibrations are transferred to the surface of the solution, creating a standing wave that generates aerosol



Components and operation principle of an ultrasonic nebulizer

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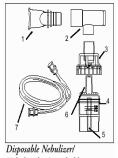
NEBULIZER FACTS NOW

Small-volume nebulizers (SVNs) are popular aerosol generators with clinicians and patients as they convert drug solutions or suspensions into aerosols that deposit into the patient's lower respiratory tract with minimal patient cooperation.

Figure 1/Figura 1

compressor

- **Device/kit that requires assembly & power -electric or battery**
- **Attaches to air compressor for converting a drug in liquid form into aerosol**
- **Kits & Parts include the medicine cup, nebulizer unit to aerosolize the liquid, the T-piece, mouthpiece or mask, tubing**
- **Passive or active inhalation of misted medication depending on age/ability**
- **Use mask (under 6yo or special needs) or Mouthpiece (6yo & up as ability allows)**
- **Keep compressor air vents free of obstruction- Place on hard surface all sides open**
- **Never wash the tubing- can become moldy, water can back up into machine**



Disposable Nebulizer/ Nebulizador Desechable

Source:
http://www.americanallergysupply.com/pulmoaide-nebulizer/devilbiss-pulmoaide-patient-guide.htm

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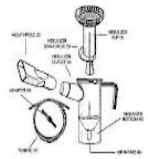
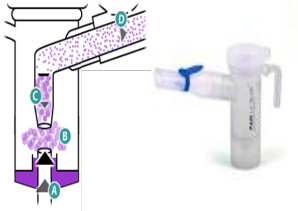
REUSABLE JET NEB VS. DISPOSABLE NEB KIT





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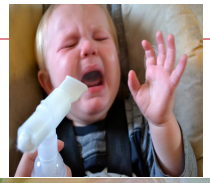
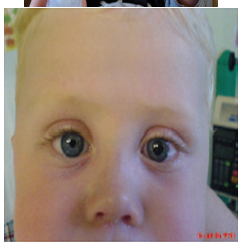
MOUTHPIECE – BLOW BY- MASK





Accessed 6/16/14 http://rc.rcjournal.com/content/53/6/699.full.pdf+html

Video clip how to use:

http://www.nationaljewish.org/healthinfo/medications/lung-diseases/devices/nebulizers/instructions/

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TIPS FOR ADMINISTERING INHALATION MEDICATIONS TO A BABY OR CHILD

- mask or mouthpiece fitted & used correctly

- Children will get the most out of treatment by breathing deeply. If child is upset or crying, treatments may not be effective
- Encourage activities that require the child to be in a seated and upright position, such as reading, watching TV, listening to music etc.

- "treasure box", sticker chart as incentive/distraction

- Allow child age appropriate participation
- If possible, secure child (seat w/ safety belt/lap) so adult are hands free
- Person administering meds keep calm, have a plan

- Before considering treatment a failure,
- check the technique

Janssens* and Harm, PAEDIATRIC RESPIRATORY REVIEWS (2006)

Accessed 6//1/15 : http://www.bing.com/images/search?q=child+nebulizer+treatments&FORM=HDRSC2#a

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CLEANING THE NEBULIZER (HOME USE)

- **After each use:**
- 1. Remove the tubing from the compressor and set it aside – this tubing should not be
- washed or rinsed.
- 2. Shake remaining solution from the nebulizer cup.
- 3. Disassemble the equipment and rinse nebulizer cup and mouthpiece with either sterile
- water or distilled water.
- 4. Shake off excess water and air dry on an absorbent towel.
- 5. Store the nebulizer cup in a clean closed container or zip-lock bag.
- **Once or twice a week:**
- 1. Disassemble the nebulizer and wash it in a mixture of warm soapy tap water.
- 2. Soak the nebulizer cup and mouthpiece for 1 hour in a solution that is one part distilled
- white vinegar (5%) and three parts hot water (1.25% acetic acid) and then rinse as above.

Accessed 6/1/15 http://www.pari.com/education_ceu/cleaning_maintenance.html

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TEACH BACK INHLATION TECHNIQUE

- Assessing your patients technique for inhalation therapy, obtain teach back (return demo, verbal)
- Why is teach back do important?
- https://www.youtube.com/watch?v=bDHEEV0M62Y

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"WHEN YOU CAN'T BREATHE, NOTHING ELSE MATTERS"

Federal trademark registration ***By:*** ***American Lung Association***