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ISMP

Nurse AdviseERR®

Educating the Healthcare Community About Safe Medication Practices

Correct use of inhalers: Help patients breathe easier

Asthma and chronic obstructive pulmonary disease (COPD) are life-long, potentially life-threatening diseases that represent the leading chronic respiratory diseases in the world.[1] Inhalation of medications is an effective method for rapidly delivering short- or long-acting bronchodilators and corticosteroids to prevent, control, and treat respiratory symptoms that accompany these diseases. Inhalation of medications may also reduce the risk of adverse drug effects because the medications can often be provided in lower doses than an oral form of the drug.

Types of inhalers

Rescue inhalers that deliver short-acting bronchodilators to relieve sudden respiratory symptoms, and maintenance inhalers that deliver long-acting bronchodilators and corticosteroids to prevent and control respiratory symptoms, are the cornerstone of managing asthma and COPD. For a list of common rescue and maintenance inhalers used in the US, visit: www.ismp.org/sc?id=1764. Inhalation devices that deliver these medications are available in four basic types:

Pressurized metered-dose inhalers (MDIs), which have been around for decades, typically consist of a small canister of medication fitted into a plastic body with a mouthpiece. Each dose is delivered by pressing the canister into the plastic body while inhaling through the mouthpiece. Use of a spacer that connects to the MDI makes it easier to inhale the dose, which is first released into the spacer and then inhaled slowly.

Dry-powder, breath-activated inhalers are preloaded with the medication(s) inside the device. Prior to use, a single dose of the medication is loaded into the mouthpiece, often by turning or twisting the inhaler body until a "click" signals the dose is ready to be inhaled. Patients simply take a deep breath while their lips are sealed around the inhaler, and a single dose is delivered (breath-activated).

Dry-powder, capsule inhalers utilize capsules as the dose-holding system, which are inserted into the device by the manufacturer or by the patient prior to use, and punctured by the device before each dose is inhaled directly from the inhaler.

Soft mist inhalers are a propellant-free liquid inhaler that provides a slow-moving, soft aerosol cloud of medicine to help patients inhale the medication, even if they can't take a very deep breath.

Errors with inhalers

The correct use of an inhaler depends on its type; thus, each manufacturer provides detailed instructions for use, some with a Medication Guide for consumers and/or a short online video to help visualize the technique. Unfortunately, up to 94% of patients with asthma and COPD use their inhalers incorrectly.[2-4] Problems are not limited to one type of device,[3] nor are they limited to patients—even healthcare professionals have made errors.[2] Misuse leads to reduced efficacy and poor outcomes. For example, in a study published in 2015, Bonds et al. found that only 7% of patients who used MDIs demonstrated proper technique; 93% made at least one mistake, and of those, 63% missed 3 or more steps in the 11-step process.[2] While most of these errors typically result in diminished drug delivery rather than no delivery at

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SAFETY wires

Misuse of new insulin strengths. Education is important for both patients and health professionals regarding the new higher concentration insulin products that are available only in a pen, including U-300 **TOUJEO** (insulin glargine), U-200 **TRESIBA** (insulin degludec), and U-200 **HUMALOG** (insulin lispro). Patients and healthcare professionals may not understand proper dosing, dose measurement, and use of these pens with higher concentration insulin products.

A patient who was previously using **LANTUS** (insulin glargine) U-100 vials was switched to Toujeo SoloStar U-300. He was given pen needles to use with the Toujeo, but at home, he decided to use the insulin pen cartridge as a vial. He drew up a dose with a leftover U-100 syringe, filling it to the mark he previously used (100 units) for his daily Lantus dose. This resulted in a dose of 300 units of Toujeo, which led to hypoglycemia requiring hospital admission.

ISMP does not recommend using pen cartridges as vials. Yet, health professionals who administer insulin have used insulin pen cartridges as vials, sometimes even with hospital authorization (www.ismp.org/sc?id=1748). With the newer higher concentration insulins, using a U-100 syringe to measure doses of insulin could lead to a serious overdose, as in the above case.

U-500 insulin is now also available in a pen (**HUMULIN**), although vials remain on the market. In the past, many patients using vials of U-500 insulin measured their dose with a U-100 syringe but used the syringe scale to measure only 20% of the actual dose. For example, 40 units on the U-100 syringe scale is 200 units of U-500 insulin.

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all, other errors have resulted in omitted doses, overdoses, and exacerbation of the underlying disease and respiratory symptoms.

Common errors made by patients using any inhaler include:[5,6]

- Not holding their breath long enough after inhaling a dose (hold for about 10 seconds or as long as comfortable)
- Using an empty inhaler, often believing an inhaler still provides doses even after the dose counter is at zero because the patient can still see or feel a "spray"
- Forgetting to exhale completely before each dose or exhaling into the inhaler
- Not using maintenance inhalers when asymptomatic

Common errors made by patients using an MDI (with and without a spacer) include:[5,6]

- Not shaking the canister or container before each dose
- Inhaling at the wrong time (not in sync with pressing the inhaler)
- Aiming the inhaler at the roof of the mouth or tongue, rather than the throat
- Inhaling an unnoticed foreign body that has entered an uncapped inhaler
- Using damaged or sticky spacer valves that limit the delivery of the medicine

Common errors made by patients using a dry-powder, breath-activated inhaler include:[5,6]

- Failure to load a dose before inhalation
- Loss of some medication by holding the inhaler mouthpiece upside down during or after loading a dose
- Failure to inhale strongly enough to draw the medication out of the device

Common errors made by patients using a dry-powder inhaler that requires loading and piercing of a capsule prior to each dose include:[5,6]

- Not piercing the capsule
- Forgetting to remove the spent capsule and not using a new capsule for each dose
- Failing to take a second breath (if indicated) to receive the full dose
- Swallowing the capsule instead of inhaling its contents
- Placing the capsule into the inhaler mouthpiece instead of the chamber designed to hold the capsule, which can result in swallowing or choking on the capsule during inhalation

Errors with newer inhalers

Over the past few years, several new devices for the administration of inhaled medications have been introduced. Some of the devices are used to administer newly marketed medications, while others contain previously available drugs in a different administration format. They were designed to address some of the problems with older inhalers and to improve the ability to use the inhalers correctly. Specifically, the newer inhalers include:

- A dose counter, which allows patients to see when the supply of medication is low. This was previously available on some dry-powder inhalers but not on MDIs.
- A longer duration of spray at a lower speed to help patients receive the full dose despite problems with coordinating the spray with the breath and the depth of the breath (e.g., **RESPIMAT** soft mist inhalers).
- The inability to activate a dose when all of the medication has been used. Once the last dose has been taken and the inhaler is empty, the mechanism to prepare another dose is locked, preventing the use of an empty inhaler.

Despite these new design enhancements to improve correct use, unfamiliarity with the newer inhalers on the market has been the source of several recently reported errors.

Case #1

A patient discharged from the hospital with new prescriptions for **ADVAIR HFA** (fluticasone and salmeterol), **PROVENTIL HFA** (albuterol), **SPIRIVA HANDIHALER** (tiotropium), and predni**SONE** was readmitted to the emergency department (ED)

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If patients now use the new U-500 pen and dial only the number of units they previously measured (40 units), the patient would receive only one-fifth of the prescribed dose. With the various high concentration insulin products now available in pens, it is important to warn both patients and health professionals about these new risks.

Updated package insert for U-500 insulin. A new package insert has been published for **HUMULIN R** U-500 (insulin regular). In the new insert (www.ismp.org/sc?id=2786), a conversion table that appeared in the previous insert to facilitate use of either a U-100 syringe or tuberculin (TB) syringe has been eliminated. The new insert states that patients using the vial must be prescribed the soon to be marketed U-500 insulin syringes to avoid medication errors. The new U-500 insulin syringes are expected to be available by November 2016 (www.ismp.org/sc?id=2803). The insert also states, "Instruct patients using the vial presentation to use only a U-500 insulin syringe and on how to correctly draw the prescribed dose of Humu**LIN** R U-500 into the U-500 insulin syringe. Confirm that the patient has understood these instructions and can correctly draw the prescribed dose of Humu**LIN** R U-500 with their syringe." Instructions on the website for patients using a vial and syringe, however, still need to be updated (www.ismp.org/sc?id=2787).

Just last month, we learned of yet another case where a patient confused markings on their U-100 syringe while using U-500 insulin. As the new package insert implies, a TB or U-100 syringe should no longer be used with U-500 insulin in vials.

Speaking of the U-500 syringes, we have confirmed the disappointing news that BD is not manufacturing a U-500 syringe with a safety needle. The U-500 syringe that will be available later this year has a 31-gauge needle that is 6 mm in length, but it is not a safety needle. This may rule out use of

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3 days later with complaints of feeling "jittery," increasing shortness of breath, and wheezing. When the patient was asked about taking his newly prescribed medications, the ED nurse learned that the patient had been taking 3 Spiriva capsules by mouth each day since discharge, unaware that the drug in the capsule was intended to be inhaled. The patient was treated and given both verbal and written instructions for use of his inhaled medications. The patient was also asked to return to a hospital clinic the following day with all of his medications to meet with a pharmacist, who provided hands-on education. Prior to leaving the clinic, the patient was able to demonstrate proper technique and verbalize when to use each inhaler. But keep in mind, education and repeat demonstration to verify understanding of inhaled medications should have occurred prior to the patient's initial discharge from the hospital, perhaps preventing a visit to the ED.

Case #2

A community pharmacist misread a prescription for **INCRUSE ELLIPTA** (umeclidinium), which was a new prescription for a patient upon discharge from a hospital, as "Increase Ellipta." The pharmacist was only familiar with **BREO ELLIPTA** (fluticasone and vilanterol) and had never filled a prescription for Incruse Ellipta prior to this incident. Because the patient was not taking an "Ellipta" inhaler previously, the pharmacist called the prescriber's office to clarify the dose of what he thought was an order for Breo Ellipta. The prescriber confirmed the dose for Breo Ellipta as 100/25 mcg per inhalation, evidently overlooking the fact that he had prescribed Incruse Ellipta for this patient. When the patient was readmitted to the hospital several weeks later for an unrelated diagnosis, another pharmacist discovered the error while collecting a medication history from the patient and investigating why he was taking both Advair and Breo Ellipta.

Case #3

A color-blind patient was unable to tell if the indicator window on a **TUDORZA PRESSAIR** (aclidinium) inhaler was red or green. The window turns green when the inhaler is loaded with a dose and is ready to use, and red when the dose has been completely inhaled. The patient mentioned this to his pharmacist when refilling his prescription. The pharmacist suggested that the patient use a pen to place a mark or dot on the green indicator to differentiate it from the red indicator.

Optimal use of inhalation devices

Because many practitioners and patients may not be familiar with the newer inhalers, we have compiled a list of proactive risk-reduction strategies to support the proper use of these and other inhalers by patients and practitioners. Consider the following:

Prescribers

- Ensure that prescriptions for inhaled medications include the medication name and strength, the device name, and the desired dose and frequency, particularly if the medication is available in more than one device format.
- When prescribing any inhalation device, consider pertinent patient characteristics, such as inspiratory flow, cognition, and manual dexterity, before prescribing the medication.
- Provide opportunities for patients to access videos on proper inhalation device technique while in the prescriber's office.
- If patients are not responding to treatment as expected, observe their technique using inhalation devices to ensure proper delivery of the prescribed medications.

Nurse, Pharmacist, Respiratory Therapist

- Obtain demonstration inhalers from the manufacturer or local lung association to provide hands-on education (it is best if the prescription is filled and the actual device is used). Maintain these demonstration devices in a segregated area away from actual medications so they don't find their way into the supply for patients.

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U-500 syringes in many hospitals that use U-500 insulin. The U-500 insulin KwikPen is available as an alternative to other types of syringes (e.g., TB syringe or U-100 syringes) that are no longer supported in product labeling.

One more thing: You should discourage staff from referring to any of the new concentrated insulins as "KwikPen" insulins. Although this is a Lilly trademark used for some of their pen devices (not the insulin contained in the pen), we learned from one hospital that staff have been referring to U-200 and U-300 products as "KwikPen" insulins, and it is causing confusion. Although no errors have occurred to date, they believe this practice could lead to errors in the future.

Are patients who are allergic to antibiotics at risk for reactions to vaccine ingredients? Several vaccines contain small amounts of antibiotics such as neomycin, streptomycin, polymyxin B, and gentamicin. The antibiotic is added to help prevent contamination of the vaccine during manufacturing. For example, the influenza vaccines **FLUMIST** and **FLUARIX** contain small amounts of gentamicin. Still, the antibiotics which are most often associated with severe allergic reactions (e.g., penicillin, cephalosporins, and sulfa drugs) are not contained in vaccines. Only minute quantities of the antibiotics remain in the final vaccination products.

According to a referenced website (www.ismp.org/sc?id=1657) maintained by The Children's Hospital of Philadelphia (CHOP), these small quantities have never been clearly found to cause severe allergic reactions. CHOP says that the possibility of severe allergic reactions caused by the trace quantities remains, at best, theoretical. The website lists the vaccines that contain antibiotics along with the quantities. Of course, not all vaccines have antibiotics, so if a concern exists, you may be able to avoid them by using an alternate brand. For example, some influenza vaccines contain no antibiotics. Another issue is that package

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- Ensure that patient education and counseling includes a demonstration of how the inhalation device is to be used. Helpful how-to videos are available from the Centers for Disease Control and Prevention (www.ismp.org/sc?id=1759), the use-inhalers.com website (http://use-inhalers.com), and product-specific websites. The use-inhalers.com website also offers free handouts for patients that provide step-by-step instructions for most inhalers in both English and Spanish.
- Focus education on essential aspects of proper inhaler use and the importance of taking all doses, and place less emphasis on aspects of treatment that allow some flexibility, such as timing between BID or q12h doses.
- Remind patients to discard an inhaler when the dose counter is at zero, even if the device continues to spray what seems to be a dose.
- Ask the patient to demonstrate inhaler technique (using a demonstration inhaler or preferably their own). Such demonstrations can create opportunities to correct improper technique, which may be a contributing factor for patients who continue to experience difficulty with symptom control in asthma or COPD. For devices using capsules, emphasize the need to place the capsule in the piercing chamber and not in the mouthpiece, and that the capsules should never be swallowed.
- Provide opportunities for patients to access videos on the proper use of inhalation devices prior to discharge.

Outpatient Pharmacists

- In addition to providing written instructions, reinforce proper and safe use of the inhalation devices during patient counseling.
- Ask the patient to demonstrate inhaler technique (using a demonstration inhaler) both when filling new prescriptions and periodically when refilling prescriptions.
- Ask patients if they discussed use of a spacer with their provider. Consider contacting the prescriber if the use of a spacer would be beneficial for the patient.
- Maintain all demonstration inhalers in a segregated area to ensure they cannot be inadvertently dispensed to patients as actual medications.

Healthcare Organizations

- Distribute this newsletter to healthcare providers to support awareness of patient errors with inhalation devices, particularly with the new inhalation devices with which they may be unfamiliar.
- Post the **summary** chart included in the PDF of the newsletter on **pages 5 and 6** for reference and to help staff and prescribers when they are providing instructions to patients. The chart provides an overview of the newer inhalation devices, the medications they deliver, and selected safety considerations to be shared with patients. It supplements, but does not replace, the information provided by the inhaler manufacturers.

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inserts often mention contraindications to "vaccine components," but an alert may not appear when an influenza vaccine that contains an antibiotic is selected from a computer listing.

We asked a major drug information vendor about this, and the company said that an allergy alert will occur only in a patient with a documented aminoglycoside allergy who is prescribed an influenza vaccine with an NDC that is associated with an ingredient set that contains trace amounts of an aminoglycoside. Regardless of an alert, though, the risk of an allergic reaction is probably minimal.

Time to get your flu shot

The Centers for Disease Control and Prevention (CDC) recommends that everyone over 6 months of age get vaccinated against the influenza virus by the end of October. The nasal spray flu vaccine should not be used this flu season. For more information, go to: www.ismp.org/sc?id=2804.

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Safety Tips for Using Newer Inhalers

Neohaler (dry-powder inhalers)

Arcapta Neohaler
indacaterol 75 mcg per capsule

Seebri Neohaler
glycopyrrolate
15.6 mcg per capsule

Utibron Neohaler
indacaterol 27.5 mcg and **glycopyrrolate** 15.6 mcg per capsule

Safety Tips (Neohaler)

- Capsules are packaged separately from the inhaler and must be inserted into the capsule chamber. The mouthpiece must be opened for capsule placement inside the capsule chamber.
- Take the capsule out of the foil right before use.
- Do not swallow the capsule.
- Only the contents of the capsule will be inhaled into the lungs.
- Inadvertent swallowing and/or choking on the capsule is possible if the capsule is mistakenly placed in the inhaler mouthpiece. If the capsule is swallowed by accident, skip that dose.
- Empty the chamber immediately after use, otherwise pieces of the capsule can remain inside and impede the free flow of medicine for the next dose.
- Discard used capsules directly into the garbage without touching, and then wash your hands.
- Put the cap back on after you are done.
- Do not use with a spacer.
- Do not take the device apart or wash it. If you want to clean your inhaler, wipe the inside and outside with a clean, dry, lint-free cloth.
- Do not breathe out into the device.
- If using more than 1 type of inhaler, ask your doctor which to use first.
- Only use the device that comes with this drug. Do not use any other devices.

Ellipta (dry-powder inhalers)

Arnuity Ellipta
fluticasone 100 or 200 mcg per dose

Anoro Ellipta
umeclidinium 62.5 mcg and **vilanterol** 25 mcg per dose

Breo Ellipta
fluticasone 100 or 200 mcg and **vilanterol** 25 mcg per dose

Incruse Ellipta
umeclidinium 62.5 mcg per dose

Safety Tips (Ellipta)

- The foil packaging and drying agent packet must be safely discarded immediately after opening.
- The colored cap should be opened before inhaling the dose. There is an audible "click" when the dose is ready to be inhaled.
- If the device cover is opened and then closed without inhalation of the loaded dose, that dose will be lost. If a dose is lost, another dose can be loaded by opening the device cover again; double-dosing will not occur.
- When the dose is ready, if the device is tipped past horizontal, medication can fall out of the mouthpiece.
- Put the mouthpiece between your lips, and close your lips firmly around it.
- Don't block the air vent (on the sides of the mouthpiece) with your fingers.
- Use only once a day, at the same time each day.
- Half of the counter turns red when there are less than 10 doses remaining, and a full solid red when the inhaler is empty.
- Do not breathe out into the inhaler.
- Close the **Ellipta** inhaler after you take your dose.
- Rinse your mouth after each use, but do not swallow the rinse water. Spit it out.
- If using more than 1 type of inhaler, ask the doctor which inhaler to use first.

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Safety Tips for Using Newer Inhalers

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Pressair (dry-powder inhaler)

Tudorza Pressair
aclidinium 400 mcg per dose

Safety Tips (Pressair)

- Before you put the inhaler in your mouth, press the green button down and release it. Do not continue to hold down the button while inhaling.
- Stop and check that the *control* window changed from red to green, which means it is ready to use.
- Insert the mouthpiece into your mouth and breathe in.
- During dose inhalation, you will hear a "click." Keep breathing in even after the "click" to ensure delivery of the full dose.
- Upon proper inhalation of the dose, the *control* window will change back to red.
- When a red striped band appears in the dose window, obtain a new inhaler. The device will "lock" when the last dose has been loaded.
- Some patients experience an unpleasant taste—rinse your mouth and swallow the water.

Respimat (soft mist inhalers)

Combivent Respimat
ipratropium 20 mcg and **albuterol** 100 mcg per dose

Spiriva Respimat
tiotropium 1.25 mcg or 2.5 mcg per actuation

Stiolto Respimat
tiotropium 2.5 mcg and **olodaterol** 2.5 mcg per actuation

Striverdi Respimat
olodaterol 2.5 mcg per acuation

Safety Tips (Respimat)

- Inserting a new cartridge into the inhaler may require more force than expected; ask your pharmacist to do it for you. (Discuss whether you or the pharmacist will "prime" the cartridge as described in the next steps.)
- Once the cartridge has been inserted into the inhaler, do not remove it until you are ready to replace it with a new one.
- Before the first use of a new cartridge, you must prime it by directing three test sprays into the air. This must be completed to make sure the inhaler is ready to use.
- Before initiating the dose, your lips should be tightly closed over the mouthpiece without covering the air vents (on the sides of the mouthpiece).
- Each dose requires the following steps (a helpful way to remember the steps for daily dosing is to remember **TOP**):
    1. **T**urn the clear base
    2. **O**pen the cap and close your lips around the mouthpiece being careful not to cover the air vents on the sides of the mouthpiece
    3. **P**ress the dose-release button and inhale
- For **Spiriva**, **Stiolto**, and **Striverdi**, repeat these steps for a second inhalation to receive the proper dose of medicine.
- When about a 7-day supply of medication remains in the device, the red pointer will enter the red zone of the dose counter on the base.
- **Spiriva** is also available in a dry-powder format (**HandiHaler**) that delivers a different dose.