Clinicians Are *Still* Talking About Single-Use Vials

Waste, cost, and “common sense” continue to rationalize healthcare providers’ use of single-use vials of injectable medications for more than 1 patient. Following publication of *Single-Use Vials: Cost, Safety, and Availability* on Medscape, many readers responded with comments either supportive of or in opposition to the Centers for Disease Control and Prevention (CDC) position statement about appropriate use of single-use vials.

This [position statement](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3415974/) restated the CDC’s long-standing position that vials labeled by manufacturers as “single-dose” or “single-use” (or even “single-unit” -- all mean the same thing) should be used only once, for a single patient, to protect against life-threatening infections. These single-dose/single use medication vials typically lack antimicrobial preservatives and can become contaminated during entry, serving as a source of infection if the vial contents are used on subsequent patients.

So, what did healthcare providers have to say?

**Single-Use Means Single Use, Period**

Is the practice of re-entering a single-use vial acceptable, “if proper basic injection practices are employed,” or is it simply “an appalling breach in safe healthcare delivery that puts patients at risk”? Both of these views were expressed by readers. In aggregate, however, most of those who joined the discussion supported using single-use vials as intended -- 1 patient, 1 dose, and 1 time.

An internal medicine physician wrote, "Patients deserve better than multiple uses from a single-dose container. Infections caused by a healthcare provider using poor technique [are] malpractice, and worse, a betrayal of trust placed in a provider by the patient." A medical student adds, "I absolutely agree. We are here to save lives and maintain the highest quality of life possible. There is no reason good enough to risk infection."

"Single-use vials don't contain preservatives," commented an oncologist. "Puncturing a vial, drawing out half the contents, and placing it back on the shelf for the next day is a recipe for bacterial growth."

Many agree that the potential consequences just aren't worth the risk, regardless of cost or availability. A pediatric nurse writes, "Some people maintain that limiting single-dose vials to one-time use is costly and unnecessary. What is the cost of a new vial of medication compared with the cost of hospitalization, blood cultures, and multiple antibiotics to treat the infection? It's a no-brainer. If it says ‘single-use,’ it's exactly that."

It is easy to see why clinicians are frustrated. A critical care nurse complained, "My hospital is supplied with 10-mL vials of folic acid with a concentration of 5 mg/mL. The dose that we use is only 1 mg; therefore, if we follow policy we would use only 0.2 mL of that 10 mL and throw the rest away. That kind of waste on a daily basis really bothers me."

A gastroenterologist described the impact on clinical practice. "During shortages of propofol and midazolam, we have to do cases with less than adequate sedation or even put off any elective cases for weeks."

For many, it seems that the frustration is magnified by the conviction that reusing single-use vials does not, in fact, endanger patients.

**What Infections?**

An oncologist asked, "What about drawing out 1 dose, then immediately drawing out a second dose? This is actually common practice in some large oncology practices."

It would seem from some of the comments that not only is this common practice, but that many healthcare providers simply don't believe that it poses significant risk to the patient. A dermatologist claimed that "thousands of outpatient
surgeons draw up local anesthetic at the beginning of the week and never have a problem, even when the lidocaine sits around in a syringe for a week."

A nurse in geriatric practice wrote, "For years, I watched anesthesiologists draw all the contents of single-use vials into several syringes for use throughout the day. Never saw a problem. There's a difference between pulling all the contents into single-dose syringes when the seal is first breached and treating a single-use vial as you would a multidose vial to be used over a couple of weeks."

These opinions beg the question: Does "never saw a problem" mean that no problems ever resulted from these unsafe practices, or that these providers were just not aware of them? To those who assume the former, a CDC representative told Medscape, "Infections associated with unsafe practices can take years to present symptoms (eg, hepatitis), so clinicians might never realize that their patients were infected." A medical student also cautions, "Don't think you are not harming patients just because the infection has not been traced back to you...yet."

Still, some healthcare providers clearly believe that the infection risk is a nonissue. An oncology pharmacist writes, "There is a widespread impression that drug vials without preservative are at risk for exponential microbial growth. This is not supported by the evidence. Microbial growth in simple solutions doesn't occur without both macro- and micronutrients present. Even in dextrose 5% in water, there is no growth. Therefore, contamination risk is a function of the number of breaches of the sterile envelope. It doesn't matter whether you use bacteriostatic solutions or plain sterile water, and it doesn't matter how long the vial sits. Sterile technique and restricting the number of punctures are the important factors. It's reasonable to use single-use vials for a limited number of entries under circumstances of high cost and supply shortages."

The problem with this belief, according to CDC, is that no data exist to inform us about how many vial entries are "safe," so we lack evidence-based guidelines. How many entries constitute a "limited" number? One entry is too many if the provider inadvertently and unknowingly contaminates the drug upon breaching the seal. If that happens, using the vial once, as intended, might result in 1 infected patient but will avoid a multipatient outbreak.

Anesthesiologists ask, "If the drug is drawn up in 2-3 sterile syringes at the same time when the vial is initially punctured (in a sterile fashion) and used within a few hours, what is the difference from the drug being drawn up in 1 larger syringe and used on 1 patient over a 3- to 4-hour case? I see patients in the ICU on propofol drips that are hanging for many hours, if not an entire day or two. That is a single-use drug and the vial has been punctured for quite a while! Is the nurse to dispose of the drug after 2, 4, 6, or 8 hours?"

Here is what the CDC has to say about it. "Drawing up doses in advance of a day's procedures, let alone a week's or more supply, puts patients at risk for infection and the clinician at risk for disciplinary or criminal consequences -- even if new needles and syringes are used. If medications become contaminated, pathogens can multiply in the vial. For example, in a recent outbreak of S aureus in an outpatient clinic in Delaware, reuse of single-dose vials for multiple patients was the only breach of safe practice identified during the investigation and represented a recent change in practice. Only 1 vial was opened at any time; each dose was drawn up in a separate, clean medication room; and each vial was accessed over a course of several hours for multiple patients until all contents were withdrawn. Seven patients at the clinic were infected with S aureus."

My Technique Is Decent

Many healthcare providers are aware of the potential risks but insist that their own diligent practice negates these risks. For example, a general practice provider described his or her procedure and beliefs. "What I do is draw up (using decent sterile technique, after cleaning the tops of even brand-new vials with alcohol and letting them dry) all the syringes ahead of time -- at one time. I do agree that just leaving a vial on a shelf for weeks or months, accessed by many providers -- most of us have seen this -- is not a great idea. But drawn up all at once and then stored for use...this is just not a problem, especially if it's for that day's use."

The waste of unused drug is often cited as rationale for allowing practitioners to do what might otherwise be accomplished by pharmacists.
"If a pharmacist can take a multidose vial and distribute it to sterile syringes and sell it as 'compounded product' at 10-20 times the cost (remember that this is what the Florida pharmacies did during the recent midazolam shortage), then why can't physicians in charge of surgical centers do the same in their facilities? Doing this in a correct way is not rocket science for trained physicians," maintained a gastroenterologist.

A surgical nurse weighed in with this comment: "Plenty of competent practitioners could be registered in a hospital or clinic facility to draw up single-dose syringes from a vial. Properly labeled and dated medications could be utilized rather than wasted."

Apparently, many practitioners believe that what is commonly referred to as "sterile technique" is sufficient to protect patients. So, why not rely on competent practitioners to draw up several single-dose syringes from a single-use vial? The problem, according to CDC, is that sterile technique at the bedside or in a standard medication or treatment room is not possible.

Standards set forth in United States Pharmacopeia General Chapter 797 (USP<797>), Pharmaceutical Compounding -- Sterile Preparations, require controlled conditions, which means International Standardization for Organization (ISO) class 5 air-quality conditions within an ISO class 7 buffer area. Essentially, this includes a laminar airflow hood and other protections to ensure aseptic handling of medication. Without these protections, the needle and syringe can be contaminated through direct contact with microorganisms or via airborne particles without a clinician realizing that a problem has occurred. Strict quality control of "beyond use" times and dates, and appropriate storage of compounded sterile products, are mandatory.

That being said, CDC emphasizes that practices with a significant need for minimizing waste during the extenuating circumstances of drug shortages might choose to have the in-house capability (physical space, equipment, and training necessary to meet USP<797> standards) for meticulously subdividing the sterile contents of unopened single-use vials (medium risk compounding) to meet their own patient care needs.

Interested clinicians can review the USP<797> standards. These standards have been made temporarily available free of charge as a resource for healthcare professionals. However, "If you split a single-use vial yourself under a laminar flow hood with appropriate personal protective equipment, it is still not as safe as a sterile unopened vial from the manufacturer," warns the CDC. The Association of Health Systems Pharmacists sells a manual, Compounding Sterile Preparations, 3rd Edition, available through their Sterile Compounding Resource Center.

CDC emphasizes that practices that use compounding pharmacies, or establish their own facility for splitting doses, must perform due diligence to ensure that procedures are compliant with USP<797> standards. State laws can differ on requirements for pharmaceutical compounding. More than ever, state pharmacy boards are looking carefully at the compounding of sterile products, and we may expect to see changes in compounding pharmacy regulations over the next year.

Frankly, My Dear, I Don't Believe It

Several of those who participated in the discussion clearly do not believe that the recent reports of infectious outbreaks justify the condemnation of reusing single-use vials. For example, an anesthesiologist wrote, "This appears to be an unfortunate case of bureaucratic overreaching based on unsubstantiated allegations. Well-trained, conscientious practitioners have, for many years, delivered medications safely to billions of patients. If proper basic injection practices are employed, there is no scientific basis for this recent indictment of medication vials. One would not throw out a gallon of milk after pouring 1 glass."

Referring to the outbreak reports, an emergency department nurse commented, "I still question these findings. I have an intubated patient with an order for 1 mg lorazepam intravenous. The vial comes in 2 mg/mL. Our hospital is broke and this patient is on Medicare or has no insurance, and you want me to get a second vial to repeat medicating this person in 15-30 minutes? It is not happening; it is purely waste."
"Although the case reports are concerning, compared with the sheer number of physicians doing this, the infection rate is likely minimal," claimed a physician. "The drug shortages that could result really should be considered by the CDC rather than their response of 'Primum non nocere.' When we waste medications and there are shortages, we are doing harm. If you are going to make policy on a few scary case reports...we are all doomed."

CDC responded to this comment. "CDC is aware of more than 40 outbreaks in recent years of disease associated with unsafe injection practices including improper use of syringes, needles, and medication vials. Because it takes fairly advanced detective work (surveillance) and often a bit of luck to detect these types of outbreaks, these 40 are likely just the tip of the iceberg. In addition, we routinely hear from medical colleagues across the country that when they look for unsafe practices, they find them -- even in the clinics advanced enough to employ quality audits."

Cutting Into the Bottom Line

Cost goes hand-in-hand with waste, and for many providers, cost is the real issue. As one pain management specialist said, "Contrast is expensive and should be used until it is gone unless manufacturers produce smaller vials. This won’t happen because it will cut into their bottom line. In the investigation of the pain clinic, other sources of infection should be considered. Contrast itself is bacteriostatic."

A pediatrician stated, "I give palivizumab to multiple patients from single-dose vials and will continue to do so. Each vial costs more than $1000, and it make no sense to throw away unused medication worth hundreds of dollars unless there is a real risk... Using an alcohol swab before re-entering a single use vial to withdraw medication does not pose any risk."

One nurse wrote, "I'm too cynical of the drug companies in that they don't want to make multiple-use vials for profit reasons. I understand the logic of not reusing a vial on multiple patients, but the same patient? Please!"

Even if providers are able to justify the risk to patients and the potential costs of treating preventable infections and settling malpractice claims stemming from patient injury, facilities should realize that failure to follow safe injection practices can also endanger a healthcare facility's "bottom line." The Centers for Medicare & Medicaid Services (CMS) recently issued a memo [3] to its state agency directors indicating that healthcare facilities that do not adhere to USP<797> standards, but reuse single-dose/single-use vials for multiple patients, must be cited for noncompliance.

CMS cites examples of what is not permissible:

- Preparation on a patient/resident care unit of multiple doses from 1 single-dose vial (even in a patient treatment room or medication room);
- A syringe with a single dose from a single-dose vial that will be administered more than 1 hour after preparation;
- Using a single-dose vial in the same manner as a multidose vial; and
- Using a single-dose vial to administer anesthesia, moderate sedation, or other medication to more than 1 patient.

CMS has received requests to relax its policies on the use of single-dose vials for multiple patients. Shortages of critically needed drugs have prompted healthcare facilities to seek ways to make efficient use of the available drug supply. Requestors maintain that wastage of vial contents that exceed the single-patient dose aggravates drug shortages. They question the CMS policy on deficiency citations when medications packaged in single-dose vials are reused for multiple patients. However, CMS has declined to change its policy.

CMS shares healthcare provider concerns about shortages but is equally concerned about healthcare-associated infections caused by unsafe medication preparation and injection practices, including using single-dose vials for multiple patients in the same manner as multidose vials. Such reuse of single-dose vials is not compliant with infection-control requirements and must be cited as a deficiency. "Remember," cautions a pharmacist, "your practice is held to the same USP standards even if you are ignorant of the standards."

Pharmacists Weigh In
Officially, professional pharmacist organizations agree with CDC’s position on appropriate use of single-use vials. Indeed, most pharmacists who contributed to this discussion voiced support for the single-use vial guidelines.

“As a pharmacist trained in aseptic technique in hospitals, I cannot understand why nurses or physicians advocate reuse of needles, syringes, vials, or any contaminated equipment on different or the same patient. Working in the vertical flow laminar hood, we don't even use the same needle to draw up drug from the same vial, and to think that healthcare providers even use the same needle (or syringe) to withdraw from the same vial in the open air to inject directly into a human being is completely disgusting. Some pharmacists will consider reusing single-dose vials if kept in the hood with no evidence of obstruction of the airflow (which maintains the aseptic integrity of the punctured vial), but I usually throw them away at the beginning of my shift unless there is a guarantee that no flies flew by.”

Answering this question from a nurse, “How do you charge for more than 1 dose from a single-dose vial?” a pharmacist wrote, ”Some hospitals charge the patient (the third party) by what is documented as administered in the electronic medical record. The system is set up to charge a single-use vial each time a dose is administered, so each time you document a dose as being given, you are charging for a full vial. There is a name for reusing a vial and charging for a new one and that name is fraud.”

Another pharmacist contends, "Repackaging medications according to USP<797> guidelines is the key to extending the supply of medications. Competent compounding pharmacists can provide this service. USP<797> guidelines require sterility testing of the repackaged products. This should be done on every batch. You should definitely consider a PCAB (Pharmacy Compounding Accreditation Board)-accredited compounding pharmacy that can provide you with test results to ensure that you have a quality sterile product. Appropriate package sizes are available if proper stability data are available."

Because so many clinicians voiced concerns about the waste involved when a single-use vial contains more drug than is needed for the patient, another pharmacist commented, "Many caregivers worry about wasting drugs that cost less than a dollar. This is penny-wise-pound-foolish. The place to save money is in prescribing -- eg, choosing less expensive drugs (usually not the latest on the market), evaluating risk-benefit, and checking with patients and family members to determine whether it is prudent to use a $25,000 drug that will not significantly extend or improve quality of life."

**Where Are the Smaller Vials?**

A nurse wrote, "Single-dose vials are meant for single use; there is no preservative to maintain a shelf life once they are opened. As wasteful as it seems, discarding leftovers is the most prudent course of action. However, it is just plain wrong for drug companies to supply large vials from which most must be wasted when only a small amount is needed per patient.” This opinion was echoed by many other healthcare professionals.

"Nobody wants to waste medicine. Why don't manufacturers make single-dose containers closer to recommended dosages in certain populations -- for example, NICU and pediatrics?” asked a neonatal nurse. Another nurse believes that "manufacturers need to make the single-use vials an amount that would be most commonly used on 1 patient. A vial of fentanyl 250 µg is too much for a single dose. Recently, I saw where a manufacturer was making hydromorphone 10 mg in a 1-mL vial. That is just an accident waiting to happen."

A physician offered this solution. "In most cases, the drawn-up syringes can simply be thrown in a freezer dedicated to that use and pulled and thawed on a syringe-warmer for use within an hour or so. But, of course, a practical solution like this doesn't even get considered -- all our administrators can think to do is draw up yet more regulations, put more burden on all of us in the field who actually do the work, and make everything more costly, while they cause shortages by such crazy ideas -- I mean, really crazy, as vials engineered to be accessible only once.”

Some, like this orthopedic practitioner, have taken matters into their own hands. "We are having our compounding pharmacy place smaller volumes of our interventional pain drugs into sterile glass vials so we can use them as needed for each case without so much waste. We save on waste, but the cost of taking a 10 cc vial of contrast agent and splitting it into five 2 cc vials is $30. This cost is non-reimbursable and is added to our per procedure costs. It works for us until manufacturers make smaller volumes available at lower costs."
Indeed, CDC is working with federal and professional partners to remove some of the barriers to safe injection practice. This includes having vials manufactured in volumes that better match patient treatment needs. Provider groups are beginning to engage more with drug manufacturers, and some are finding that they are able to negotiate on price.

When asked why manufacturers don’t make smaller single-use vials of sterile medications, Lisa Kubaska, PharmD, of the US Food and Drug Administration (FDA), responded in an email to Medscape, “Manufacturers determine the amount of drug in single-use vials. Individual patient dosage amounts can vary based on a wide range of circumstances (eg, patient weight) that are evaluated by medical professionals at the time of drug administration.”

The FDA also emphasizes that “even if a single-use vial appears to contain multiple doses or contains more medication than is needed for a single patient, the vial should not be used for more than 1 patient nor stored for future use on the same patient. To prevent unnecessary waste or the temptation to use contents from single-use vials for more than 1 patient, healthcare personnel should select the smallest vial necessary for their needs when making purchasing decisions.”

Clinicians also ask, “Why can’t preservatives be added to all vials to inhibit growth of microorganisms?” Joseph Perz, DrPH, MA, of the CDC’s Division of Healthcare Quality Promotion, responds that even if this was a common practice, it would only affect the growth of bacteria, yeasts, and fungi. Many outbreaks, including some of the largest, involved viral infections such as hepatitis B and C. [4]

Moreover, adds the FDA, preservatives (eg, antimicrobial substances) are, by their nature, potentially toxic. Preservatives can be particularly dangerous when administered by the epidural or intrathecal route because of direct access to the central nervous system. Typical pharmaceutical preservatives include benzyl alcohol, methylparaben and propylparaben, phenol, sulfites, polyethylene glycol, and thimerosal. The public is wary of the effects of, and the need for, preservatives in anything, and they have received much bad press, some of which was not justified. [5] Nevertheless, this has contributed to a trend toward preservative-free pharmaceuticals. Formulating drugs with preservatives that are stable and effective, without being toxic to human cells, is a challenge. [6] In any case, preservatives, when present, cannot substitute for safe injection practices.

Not Me or My Family!

A nurse expressed this view. "I have always complained about wasting meds, but having read about the actual case reports of serious infections from accessing single-dose vials more than once, I have changed my thinking on this. Meds may be expensive, but the human and financial cost of infections is certainly more expensive.”

Several other commenters added that they wouldn’t want such practices to be used in their own care or in that of their families. "As a healthcare professional, I can understand the cost and medication shortage issue, but as a consumer I am fearful for myself. If I wouldn’t risk any type of infection on my own family, why would I do it to another person’s family? A small risk it may be if medications are prepared properly, yet it is a risk that we should not be willing to take. I am not willing to risk any patient's life over costs or shortages.”

Nevada resident and school administrator Harry Chanin would agree with this sentiment. Here is his story:

I underwent a routine colonoscopy for screening purposes in June 2006 and presented with acute hepatitis C infection 8 weeks later. I went through an ordeal of chemotherapy that luckily for me (the success rate is only 50%) suppressed the virus. I suffer lingering fatigue and chronic joint pain as a result of the treatment side effects.

The outpatient clinic where I had my colonoscopy was administered by doctors who decided to consciously cut whatever corners they could to speed things up and increase their billings. They were supplied the anesthetic propofol in 50-mL vials by drug manufacturers who knew these vials were being used for multidosing patients, but who continued selling them because their profits were higher given the lower packaging costs of bigger vials.

The Nevada outbreak was the result of systematic failure of the entire healthcare delivery system. The insurance company that directed me to the clinic never checked on the quality of the care being provided; the doctors ignored their
oath; and the drug manufacturers put profits over safety, consciously. The system has repeatedly failed. [Personal communication; December 4, 2012]

Web Resources

CDC has introduced a new suite of practical resources to help clinicians follow and evaluate safe injection practices. These include:

- **Bloodborne Pathogen + Safe Patient Injections Training** (for individual or group training)
- **Safe Injection Practices - How to Do it Right** (animated video)
- **Safe Use of Insulin** (demonstrating proper use of insulin pens)
  - Poster
  - Brochure

References


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