

Baxa Corporation

**The Role of Oral Dispensers in Clinical
Research Best Practices**

Technical Paper

A review of the opportunities to improve the methods and processes in the studies that precede drug release.


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Abstract

Oral dispensers (aka syringes) have long been recognized as the safest and most accurate method to administer oral liquid medications. These advantages are greatly magnified in pediatric and hospital environments where potential confusion with intravenous and enteral lines and inhalation systems make dosing with standard hypodermic syringes even more dangerous. There are also opportunities to improve the methods and processes in the studies that precede the drug release. This paper concludes that oral dispensers are also the best practice in clinical research studies that involve oral liquid medications.

Overview

The vast majority of drugs are taken orally. Oral drug administration is generally done one of two ways. Solids are by far the most common and usually are tablets or capsules. Liquid formulations also exist for many drugs that have the clinical need and chemical stability.

Liquid doses most often are preferred in patients unable to use solid forms due to their clinical condition, young age and particularly to individualize the dosage. Dosing titration of liquid medications is also far easier than with oral solids.

Measuring drug liquids accurately is more difficult than just taking whole tablets or capsules. The most basic methods used to measure and administer drug liquids in the home have been the venerable “teaspoon” and “tablespoon.” An all-too-common method in hospitals is the standard injectable hypodermic syringe. The problems with each are explored in the following sections.

Administering oral liquids at home

For many years, pharmacy practice generally assumed that a teaspoon is 5 mL and that a tablespoon is 15 mL. Unfortunately, this is not consistently true. A simple study by Kimminau published in 1980 documented the tremendous range of errors possible by actually measuring the results from a group of measuring devices.¹ Kimminau concluded that oral syringes are probably the best device available. Dedicated oral syringes are also referred to as oral dispensers as the terms are used interchangeably.

About the same time, another extensive summary article on administration of oral medications to infants and young children concluded exactly the same thing. The author noted that the volumes of household teaspoons can range from 2.5 mL to 9.7 mL². The deviation becomes even greater when different individuals fill the same teaspoon. The studies showed that the actual prepared volume was rarely close to 5 mL.

The above results are also far outside of the NF and USP standards of a $\pm 10\%$ error dosage range for oral dosing devices. It's safe to say that predictable clinical outcomes should not be expected if actual drug dosing is this random due to the measuring containers.

Unfortunately, the issue of inaccurate dosing and accidental overdoses continues to this day. A 2006 Institute for Safe Medication Practices Safety Alert alerted readers to the possible dangers of accidental childhood acetaminophen overdoses³. The article further suggests that oral syringes may be more accurate than manufacturer-provided dosing cups.

Oral dispensers are superior dosing containers beyond just accurate measurement. Drawn up doses can be expelled directly into the side of the patient's mouth to minimize spillage. This is particularly true with small children who tend not to stay still for drug dose delivery. Oral dispensers also allow small amounts of a drug to be administered at once. Viscous drugs are more effectively and completely administered because a plunger can exert pressure on the liquid. Oral syringes are also reusable in a home setting.

Injectable syringes tend to be a far larger danger in hospitals, but due to their very wide availability and lower cost, may be dispensed for use at home. An FDA Consumer Magazine noted that multiple children have choked on the plastic caps of hypodermic syringes prefilled with drug when the care giver expelled the drug and integral cap literally down the throats of pediatric patients.⁴ One 6-month-old girl even required cardiopulmonary resuscitation following an incident. The problem is that the caps are so inconspicuous as to look like an integral part of the syringe to the untrained eye.

Administering oral liquids in the hospital

Hospitals and clinical settings share all of the problems of dosing oral liquids at home except for the use of teaspoons and tablespoons. Medication cups are frequently used to measure liquids in hospitals but many nurses still use the standard injectable syringe to capture the benefits of oral syringes if such a container is not available.

Drawing up oral doses in injectable syringes immediately presents one obvious overwhelming danger. That is the potential to inadvertently inject an oral medication into an intravenous line. Unfortunately, this has been done far too many times and is the primary reason for using oral syringes in hospitals. Enteral liquids drawn up in injectable syringes pose the same danger. The wrong route of administration can easily be used in the confusion of the various tube sets that are present at a patient's bedside. Inhalation products drawn up in injectable syringes, frequently prefilled for operator convenience, represent yet another danger. Of course there is always the possibility that any liquid drawn up in an injectable syringe inadvertently could be injected.

The safe alternative to confusing non-injectable liquids as injectable, by their being in hypodermic syringes, is to use dedicated oral dispensers. These syringes have specially engineered hubs that cannot be connected to standard IV lines and cannot accommodate a needle attachment. They are clearly the best choice for pediatric patients and those most at risk from dosing, or wrong route of administration, errors.^{5,6,7}

Implications for administering oral liquids in clinical research studies

Clinical trials share many of the issues with both the previous settings but are also unique. Wrong route of administration is typically not a big concern for clinical trials that are usually in a controlled environment or at home. The primary value for the oral dispenser for clinical trial use is accurate dosing. Researchers should recognize the improvement in data integrity that is achieved through delivering exact doses during trials. Ease of use also encourages study compliance and having participants take the entire dose without spilling definitely contributes to improved data integrity.

Drug studies also can require change or titration of doses during the process. Oral liquid doses can be changed far easier than solid forms that might require the compounding of whole new tablets or capsules. But, the advantage of oral liquids in managing dosage changes is realized only if the new liquid dose is measured accurately.

Summary

In the end, the goal of any study is to get good results the first time, collect and record accurate data and complete the study on time. Clinical research organizations selling their services to big pharmaceutical companies could improve their work product by using oral dispensers in studies with oral liquid medications. Best practice for oral liquid dosing is to use an accurate and safe dosing device. There is no device more safe and accurate for oral liquid medications than the oral dispenser, whether in the inpatient, outpatient or home setting. It's time that dedicated oral dispensers become the standard of practice in applicable clinical research studies.

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