

Acute Care

ISMP Medication Safety Alert!®

Educating the Healthcare Community About Safe Medication Practices

Draft Guidelines for the Safe Communication of Electronic Medication Information



Electronic health records (EHRs), computerized prescriber order entry (CPOE) systems, electronic medication administration records (eMARs), and electronic prescribing (e-prescribing) systems are health information technologies (HIT) being widely adopted by healthcare providers in a national effort to improve the quality and safety of healthcare.¹ According to a 2014 national survey, more than 80% of US hospitals have implemented inpatient CPOE systems with clinical decision support, 93% have implemented eMARs, and 94% have partially (60%) or fully (34%) implemented EHRs.² In the outpatient setting, more than 94% of US pharmacies are accepting electronic prescriptions (eRx) from more than half of prescribers who are using these systems.^{3,4} The most substantial increases in implementation have occurred during the past 3 to 4 years due to federal incentives. As of July 2015, more than \$20.9 billion in incentives have been paid to Medicare and Medicaid healthcare providers for HIT implementation that demonstrates meaningful use.⁵

Examples of hazards

While EHRs, CPOE, eMARs, and e-prescribing systems have quickly become a mainstay in healthcare, their introduction has brought about significant changes in how medications are prescribed, dispensed, and administered. If the conventions used to communicate this information electronically are not carefully considered, these forms of HIT and others may actually contribute to medication errors rather than mitigate the risk.

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ISMP comments on BD syringe potency issue

It has been 4 weeks since we published an article about the loss of potency of certain medications when prepared in BD 3 mL and 5 mL syringes that are not administered shortly thereafter. According to a BD representative, this may be related to a problem with syringe plunger stoppers from a secondary supplier. Since our publication, BD and the US Food and Drug Administration (FDA) have issued communications that indicate the issue is more complicated than we initially realized. We thought that once the stopper situation was resolved, the problem would disappear. However, we now realize that these syringes were never cleared by FDA for use as a closed container storage system for drug products, and the suitability of these syringes for that purpose has not been established. This calls into question what hospitals have been doing for years—preparing unit dose syringes in the pharmacy in advance of anticipated use, or obtaining prepared syringes from outsourcers. These efforts take advantage of quality control mechanisms that exist in a pharmacy admixture program or outsourcing facility, and provide injectable medications in ready-to-use containers.

FDA has suggested that medications drawn into syringes should be “administered promptly.” This statement requires hospitals to decide what “promptly” means, although FDA, BD, and others are actively engaged in trying to determine how quickly a potency problem can develop in the syringes of concern. But we need to keep safety in balance.

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SAFETY briefs



HIGH-ALERT

Intracardiac EPINEPHrine stocked in error in place of IV EPINEPHrine syringes.

Several practitioners from different hospitals reported that they have inadvertently purchased and stocked prefilled emergency syringes of EPINEPHrine 1 mg/10 mL for intracardiac injection rather than a formulation for intravenous (IV) use. The intracardiac syringe has an attached 18 gauge, 3 1/2 inch needle. Incorrect products have been used to stock crash carts, floor stock, and automated dispensing cabinets. The way suppliers describe the product in computer listings contributed to the errors. As seen in Figure 1, one wholesaler includes the needle gauge and length, but not the word “Intracardiac,” which is a serious omission. Some wholesalers fail to even mention the needle length. IV formulations of EPINEPHrine sy-

EPINEPHRINE 1 MG-ML MDV 30 ML	
EPINEPHRINE 1:10000 18GX3.5 SYG 10X10 ML	10X10
EPINEPHRINE 1:10000 SYG 10X10 ML LFS	10X10

Figure 1. Wholesaler listing for intracardiac EPINEPHrine fails to mention “intracardiac.”



Figure 2. The word “Intracardiac” is hard to see without the arrow pointing it out.

intracardiac medication carton is long and narrow compared to the prefilled IV syringe of EPINEPHrine, the word, “Intracardiac,” can easily be missed (Figure 2) during the

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ringes are currently in short supply, which also may have contributed to the accidental purchase of the intracardiac syringes. Also, although the

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In our newsletters, we have often detailed how poorly conceived abbreviations or dose expressions used in HIT software can make it difficult to differentiate between 100U and 1000, 1.0 and 10, or look-alike drug names. We have described the misidentification of alphanumeric symbols with electronic communication and provided a table with dozens of examples, including how the lowercase letter l looks exactly like the numeral 1 or the uppercase letter I, and the uppercase letter O looks just like the numeral 0.

We have described electronic communication errors caused by restricted character spaces or truncated listings that made it impossible to communicate the full name and dose of a medication (e.g., an order for Novo**LOG** Mix 70/30 FlexPen appeared as “NovoLog Mix FlexPen 70” due to a limited number of characters per field). We have tied the size limitation of drug inventory fields with forcing the use of unsafe drug name abbreviations (e.g., APAP, HCTZ) or truncated names for investigational drug name codes. We have also reported errors associated with a failure to maintain a space between the drug name, dose, and units of measure. For example, Amaryl2 mg has been misread as 12 mg.

We have reported that some HIT software platforms do not allow the use of tall man letters for dissimilar parts of drug name pairs with look-alike names. We have provided numerous examples of unsafe HIT defaults that are used to prepopulate fields or to populate fields with missing data—a default to teaspoons rather than mL for oral liquid medications is an example. We have pointed out that large doses without properly placed commas have been confused—for example, 100000 has been mistaken as 10000 (10,000) or 1000000 (1,000,000). We have provided examples of misinterpretations of symbols, dose designations, and abbreviations known to be error-prone (e.g., QD, tPA, > and <, IT) when used in electronic communications. Some of these errors have led to patient harm.

Guidelines for electronic medication information

To avoid errors, HIT vendors and users need a set of accepted guidelines related to the safe presentation of electronic data associated with medication information. There are quite a few standards already promulgated for various aspects of HIT, particularly related to the exchange, integration, interoperability, sharing, security, and retrieval of HIT. These standards have arisen from various national-level sources, including Health Level Seven International (HL7), Digital Imaging and Communications in Medicine (DICOM), National Uniform Billing Committee (NUBC), The Accredited Standards Committee (ASC) X12, National Council for Prescription Drug Programs (NCPDP), National Committee on Vital and Health Statistics (NCVHS), the Health Insurance Portability and Accountability Act (HIPAA), the federal EHR Incentive Program, and Healthcare Information and Management Systems Society (HIMSS) Electronic Health Record Association (EHRA).⁶⁷ However, these and other standards-setting sources have not compiled a robust list of guidelines to promote the safe communication of electronic medication-related information.

To address this need, ISMP has compiled a set of **Draft Guidelines for the Safe Electronic Communication of Medication Information** (pages 4-6). We examined the literature and other credible sources to identify potential confusion that is unique to electronic communication or that affects both paper and electronic records, and then developed the draft guidelines. The scope of the draft guidelines is narrow and covers only issues that deal with how information about medications is communicated in electronic formats, including EHRs, CPOE systems, eMARs, pharmacy computer systems, e-prescribing systems, and other displays of electronic health information when using barcode scanning systems, smart infusion pumps, and automated dispensing cabinets. We encourage you to share your comments about the draft guidelines with us by **October 16** via email at: isminfo@ism.org, or by visiting: www.ismp.org/tools/guidelines/SCEMI.

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flurry of activity surrounding a code, especially when the syringe is stored on its side or standing up in crash cart supplies.

We have asked Hospira to look into making the word “Intracardiac” much more prominent on the label, and including it on the top and side panels as well, so the word can be easily seen no matter how the syringe is oriented when stored. Transthoracic intracardiac **EPINEPHrine** is generally considered to be obsolete, replaced by endotracheal or intraosseous routes when an IV is not accessible. During emergency thoracotomy, where intracardiac injection may prove useful, **EPINEPHrine** can be administered using a smaller needle, such as a 1½ inch, 22 gauge needle, which also may reduce potential trauma to the ventricle and coronary arteries. So, a valid question is, are these syringes still around by tradition, and are they truly even needed?



Insulin syringe needle length. We are interested in learning about the needle length typically used with insulin syringes (including insulin pens) in your hospital. Multiple needle lengths, from 4 mm up to 12.7 mm (½ inch), are available on insulin syringes, and you may use more than one size. Please take a few minutes to visit our website home page (www.ismp.org) to complete a 1-question straw poll on this topic (located in the lower left near the bottom of the webpage).

ISMP conducts these 1-question polls regularly. Our previous poll collected information about whether brand or generic names are used to prescribe medications. The results are in the table below.

In your acute care organization, how are medications most commonly prescribed?

Answer Choices (N=1,365)	Number of Responses	Percent
By brand name only	231	17%
By generic name only	455	33%
By either brand or generic name	679	50%

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After the comment period, we plan to finalize the guidelines and submit them to The Office of the National Coordinator for Health Information Technology (ONC HIT), which has been given responsibility for the harmonization of standards for HIT from multiple sources. We also plan to share the guidelines with HIT vendors, standards-setting organizations such as The Joint Commission and the Centers for Medicare & Medicaid Services, and HIT-related professional organizations. We hope vendors will work cooperatively with their user facilities to improve the safety of the electronic communication of medications.

References can be found at the end of the **Guidelines** on page 6 >

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It is important to consider the broader safety implications that can develop in response to this issue. Already, some have contemplated dispensing glass vials with exact doses so nurses can prepare syringes immediately before use. Breaches in aseptic technique and unlabeled syringes in patient care units could lead to contamination or medication errors. Other hospital pharmacies have started preparing and delivering prefilled syringes immediately before injection. But the resources associated with this are difficult to muster, and errors may increase if redeployed staff are taken away from normal safety functions.

The BD syringe issue also brings to light important information to consider when using syringes to store medications. Hospitals may be relying on literature to support the beyond-use dating of medications stored in syringes, or they may believe a beyond-use date of 24 hours or less is sufficient to ensure the products' potency when stored in a syringe (as noted in the July 31 BD letter). However, to validate beyond-use dating for a product drawn up in syringes, testing would be needed to monitor drug potency over the period of time intended to store the product in the syringe, plus additional time for a margin of safety, for assurances about potency. Such testing may be beyond the capability of many hospitals to perform. However, outsourcers can be expected to supply assurances regarding stability data for the beyond-use date of available syringes and the drugs they hold, as they must follow FDA Current Good Manufacturing Practices (CGMPs).

You should bear in mind that syringe manufacturers can change components of their syringe, potentially rendering the stability information unreliable. Hospitals and compounding facilities that use syringes to store drugs should inform the syringe manufacturers, and syringe manufacturers should provide public notification when modifications are made that could affect the stability of drugs stored syringes.

We all need to work together to acquire information to better understand this issue, but for now, we cannot suggest that radical changes are warranted to what is currently the norm. Hospitals should try to limit drug exposure in plastic syringes by using them as promptly as possible after preparation in the pharmacy. Make sure that clinical staff are aware of the situation and know to report unexpected changes in drug effectiveness, such as a sudden loss of pain control, especially with infusions via a syringe pump. Monitor patients for signs of decreased efficacy when administering drugs that have been stored in syringes, and use caution when administering sequential doses to avoid a sudden increased effect that could occur when switching from a syringe of medication stored for a period of time to a newly prepared syringe. Assign staff to watch for new FDA, BD, ISMP, ASHP, or other alerts, because more information may become available. Also, work with BD to understand whether any syringes in your institution belong to lots that are affected by this issue. According to information on the ASHP website dated August 21, customers who want to know whether their BD general use syringes are affected with the secondary supplier's stopper should contact the company at 201-847-4500 or via drug_potency@bd.com and be prepared to state the lot number.

 **Special
Announcements****ISMP webinar**

Join us on **September 29** for our next webinar, *Expanding Our Reach: Inpatient Pharmacists Reducing Readmissions Within a Health System*. Following the 2012 launch of the Hospital Readmissions Reduction Program, health systems have been seeking strategies to prevent patient readmissions. During the webinar, our speakers will describe their experiences with a successful pilot program using pharmacists at the point of discharge to prevent readmissions due to medication misadventures. Learn about workflow adaptation, preliminary outcomes, patient care interventions, program expansion, and how to manage the challenges with this important work. For details, please visit: www.ismp.org/sc?id=349.

External job postings

Did you know that ISMP has a job posting site for external medication safety career opportunities? Employers can submit job opportunities to ISMP to be posted on the site. The latest postings for jobs can be found at: www.ismp.org/jobline/joblist.asp?mode=E.

ISMP Cheers Awards

Each year, ISMP celebrates individuals and organizations that have set a standard of excellence in the prevention of medication errors during the previous 12 months. **Nominations for this year's Cheers Awards will be accepted through September 11.** We also invite you to join us for a gala dinner at The Chicory in New Orleans on **December 8** (during the American Society of Health-System Pharmacists Midyear Clinical Meeting) as we celebrate this year's winners! Visit www.ismp.org/Cheers/ to submit a nomination, register for the gala (click on Support), or make a donation to support ISMP medication safety efforts.

Draft Guidelines

for the

Safe Electronic Communication of Medication Information

Safe presentation of drug nomenclature and dose expressions

1 List all medication-related products by generic name using all lowercase letters (unless using tall man letters as mentioned in item #8) as the primary expression of drug nomenclature, ensuring that each matches US Food and Drug Administration (FDA)-approved nomenclature so that electronic medication records agree with all package labels.

2 Do not include the salt of the chemical when expressing a generic drug name unless there are multiple salts available (e.g., hydroXYzine hydrochloride and hydroXYzine pamoate). If the salt is used as part of the name (e.g., US Pharmacopeial Convention [USP]-approved abbreviations such as K [potassium], Na [sodium], HBr [hydrobromic acid], and HCl [hydrochloric acid]), it should follow the drug name, not precede it.

3 As appropriate, list associated brand names in a requisite field using an uppercase first letter (unless using tall man letters). Although the use of all uppercase letters is a standard convention for trademarks, mixed-case and lowercase letters are more unique and distinguishable than all block-like uppercase letters, which look similar especially in low lighting.⁸ Trademark symbols (e.g., TM, ®) should not be used.

4 Express suffixes that are part of the drug name (e.g., SR, CD, CR) within both the generic name field and the brand name field (e.g., diltiazem CD, Cardizem CD).

5 Do not abbreviate drug names (e.g., MTX for methotrexate has been misunderstood as mitoXANtrone; MSO₄ for morphine sulfate has been misinterpreted as magnesium sulfate).

6 Do not use outdated terminology when referring to medications or solutions (e.g., “heparin lock flush” for saline lock) or medical jargon that may not be as clear as familiar lay terms (e.g., “ophthalmic” and “otic” can be more clearly expressed as “eye” and “ear”).

7 Avoid using drug protocol acronyms (e.g., CVP) without defining the protocol (cyclophosphamide, vinCRISTine, predniSONE) at least once within the electronic communication.

8 Use tall man bolded letters (e.g., DOBUTamine and DOPamine) to help distinguish look-alike products on screens to minimize the risk of selecting the wrong product when medication names appear alphabetically in look-up lists. See www.ismp.org/Tools/tallmanletters.pdf for *FDA and ISMP Lists of Look-Alike Drug Names with Recommended Tall Man Letters*. Pharmaceutical manufacturers are required to use tall

man lettering for drug names on the FDA list.

9 Avoid the use of known error-prone abbreviations, symbols, and dose designations, including those on the *ISMP List of Error-Prone Abbreviations, Symbols, and Dose Designations* (www.ismp.org/Tools/errorproneabbreviations.pdf) that may cause confusion in electronic formats. Examples include:

a Do not use trailing zeros when expressing medication/solution doses (e.g., use 5 mg, never 5.0 mg).

b Use leading zeros for doses less than 1 measurement unit (e.g., 0.3 mg, never .3 mg).

c Spell out the word “units.” Never use the abbreviation U, which easily can be mistaken as a zero, causing a 10-fold overdose. Never abbreviate international units as IU, which has been confused as IV (intravenous); this measure can be expressed as “units” alone.

d Include properly spaced commas for dose numbers expressed in thousands or millions (e.g., 5,000 units).

e Express weights and measures in a standard fashion and use USP standard abbreviations for dosage units as follows:

(1) cm = centimeter

(2) m (lowercase) = meter

(3) kg = kilogram

(4) g = gram

(5) mg = milligram

(6) mcg = microgram

(do not use the Greek letter mu [μ], which has been misread as mg)

(7) L (uppercase) = liter

(8) mL (lower-/uppercase) = milliliter

(do not use cc which has been misread as U or the number 4)

(9) mEq = milliequivalent

(10) mmol = millimole

f Do not include a period after dose designation abbreviations (e.g., mg.).

g Do not use apothecary system designations or symbols (e.g., grains, drams, minims), or household measurements (e.g., teaspoon, ounces).

h Do not use IN as an abbreviation for intranasal (may be confused with IV or IM); use “intranasal” or “NAS.”

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i Do not use IT as an abbreviation for intrathecal (may be confused with other routes such as, intratracheal, intratumor, inhalation therapy, intratympanic); always spell out “intrathecal.”

i Do not use the abbreviations o.d., OD, q.d., QD, or q1d for daily; spell out the word “daily.”

k Do not use the abbreviations AD, AS, AU, OD, OS, and OU, to direct into which ear(s) or eye(s) to instill a medication; write out left ear, right eye, and so on.

l Do not use the abbreviations q.o.d. or QOD for every other day; spell out “every other day.”

m Do not use < or > signs; spell out the intended terms “less than” or “more than.”

See item #16 for a recommendation to provide adequate space in corresponding fields so these abbreviations do not need to be used.

10 Use the typical smaller font for fractions (i.e., ½ not 1/2) to express a partial tablet.

11 When the drug name, strength, dosage form, and dosage units appear together, list the generic name first, followed by brand name, strength, dose (if different than strength), and the dosage form (e.g., timolol [Timoptic if brand dispensed] 0.5% ophthalmic solution; diazepam 5 mg tablet). When the strength and dose differ, also list the amount needed for the dose (e.g., propranolol 5 mg [½ x 10 mg] tablet) on the eMAR.

12 When the drug name, strength/dose, and the unit of measure appear together, require a space between the drug name and strength/dose (e.g., propranolol20 mg has been misread as 120 mg), and between the dose and unit of measure (10Units has been misread as 100 Units).

13 Include the name(s) of the drug and the patient-specific dose (not just the strength dispensed) on the same line/entry on eMARs. Avoid entries where the name of the drug and available dosage strength are on the first line, and the patient-specific dose is on the next line.

14 List the most commonly used or preferred drug, strength, and dose first, if multiple drugs, strengths, and doses are available from which to choose.

► **Design features that support safe communication**

15 Use easy-to-read, larger size fonts not densely compressed when expressing electronic text.⁸ Familiar sans serif fonts without embellishments are preferred. However, serifs do not matter as long as the font style is not extreme or unusual.

16 Provide adequate space for items in data fields used to communicate drug names, dosing units, routes of administration, and frequencies. Two or three character fields force the use of potentially dangerous abbreviations.

17 If numbers are needed to sequence medication orders, provide adequate space between the numbers and the drug name to prevent misinterpretation of the sequencing number as the medication dose.

18 Provide a field to enter the purpose/indication for all medications communicated electronically. Require entry of the purpose/indication for the following types of medication orders: all as needed (PRN) medications; look-alike products (www.ismp.org/Tools/confuseddrugnames.pdf) that are known to be problematic (few look-alike name pairs are used for the same purpose); and medications that have different dosing based on the indication (e.g., desmopressin for hemophilia or diabetes insipidus) or have multiple indications not included in the approved labeling (e.g., most prescriptions for gabapentin are for off-label uses such as neuropathic pain syndrome, generalized anxiety, social phobia, migraine therapy). Communicating the drug's indication reduces the risk of improper drug selection and offers clues to proper dosing when a medication has an indication-specific dosing algorithm.

19 Require entry of the minimum components of a complete medication order or prescription (drug name, metric dose, frequency, route, indication). Do not allow doses prescribed only by volume, number of tablets, or number of vials/ampuls (exceptions include combination liquid medications available in a single concentration, eye and ear drops, creams and ointments, liquid multivitamins). Do not permit entry of range orders without objective measures to determine the correct dose.

20 To prevent the risk of misinterpretation, do not allow the components of a complete medication order or prescription to be created using a combination of both discrete fields and free-text fields (which could conflict or lead to misinterpretation). Limit the need for free-text entries in e-prescribing and CPOE systems by providing a “special instructions” field with a menu of choices related to common precautions for specific drugs (e.g., patient assessments, antidotes, avoidance of concomitant medications). Allow full capability of free-text entries in the pharmacy computer system to facilitate communication of important information among pharmacists (via pharmacy computer screens) and nurses (via eMARs).

21 Provide users with ways to emphasize medication- or patient-related warnings or other important clinical notes related to prescribed medications (e.g., upper- and lowercase letters, contrasting color, bolding, italicizing, choice of fonts, audible alerts). When appropriate, warning statements should be presented in the active voice using affirmative statements instead of negative statements to ensure people understand the meaning of the hazard even if they don't read every word.⁸ For example, “For Oral Use Only” should be used instead of “Not for IV Use,” which a practitioner could misread as “IV Use” if viewing just a portion of the warning.

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22 Provide users with the ability to search by brand name, generic name, short name, or mnemonic, and link all means of accessing a name to default to a generic name. Also, organize generic and brand names by dosage form in look-up tables (e.g., multiple gentamicin products should be organized by parenteral injection, ophthalmic solution, cream, and other dosage forms).

23 Provide the ability to clearly communicate medications prescribed for specific, non-routine administration times or under certain conditions (e.g., with dialysis, while NPO, until tolerating liquids, prior to surgery).

24 Provide the capability to link all closely associated drug therapies so that they appear sequentially together on profile screens and eMARs (e.g., orders for PCA should be linked to corresponding orders for nausea, itching, and breakthrough pain), and also to facilitate discontinuation of associated therapies when the primary therapy is discontinued.

25 Provide the capability for users to link medications only to the appropriate routes of administration available for each drug. For example, vinCRistine injection should link only to the intravenous (IV) route of administration.

26 Provide a mechanism to facilitate safe order entry of complex medication regimens (e.g., chemotherapy, electrolyte solutions, parenteral nutrition) or drugs that require a tapering dosing schedule (e.g., steroids) so that the orders appear clearly and in a logical sequence, and include all required elements (which may be different than for routine medications).

27 For weight-based/body surface area-based pediatric medication orders, include required fields for both the mg/kg dose (or mg/kg/hour, mcg/kg/min, mg/m², or similar dosing formula) and the total calculated dose.

28 Provide a mechanism to place medication orders on hold under specified conditions, and to alert users at specified times to remind them that doses have been held.

29 See ISMP guidelines for designing medication labels generated from electronic systems for use in the acute care and community pharmacy settings (www.ismp.org/Tools/guidelines/default.asp).

Prompts for patient information closely related to medication use

30 Provide fields that require electronic documentation of patient allergies (including food allergies) and associated reaction in a format where the allergy and reaction appear next to one another, prior to the entry of medication orders (except in emergencies).

31 Allow only metric measurements of patient height (in cm only) and weight (in kg only [or grams for low birth weight infants]), and include a field to document the date the weight was collected.

Other topics for which further investigation and standards are needed

32 If mnemonics or short names continue to be used, standards are needed that allow practitioners to access a particular medication list without entering the full name.

33 Use human factors data to select the appropriate character, text, and colors to use with electronic displays of information. For example, the contrast ratio for alphanumeric characters/text to the self-luminous computer screens or displays should not be below 7:1. Never display pure red text on a pure blue background or vice versa; never use pure blue or red text on a black background; and never use pure blue for text or fine details on electronic displays.⁹

34 A standard process is needed for expressing combination and compounded products, including products that are often referred to by coined names (e.g., banana bag, magic mouthwash). Currently, coined names can be used if the contents of the product are standardized and available for reference to prescribers, pharmacists, and nurses.

Guidelines—continued from page 3**References**

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