



## Confusion over the meaning of color-coded wristbands

A hospitalized patient with a prior anaphylactic reaction to latex was given a green bracelet which, at that hospital, signaled a latex allergy. During his stay, he was transported to a diagnostic center for a test. Staff at the center were not aware that green bracelets meant a "latex allergy," so they performed the test using latex-containing vials/syringes. The patient experienced an anaphylactic reaction and required medical treatment to correct the situation.

An interesting survey of Pennsylvania (PA) hospitals, surgery centers, and birthing centers was conducted by the PA Patient Safety Authority and published in a *Supplementary Advisory*.<sup>1</sup> The survey found that four out of five facilities used color-coded patient wristbands to signal important medical information. However, wide variation existed among the facilities regarding the colors used to communicate information via wristbands (see Table). Thus, the risk of confusion is great.

The Advisory included another event in which a patient had been incorrectly identified as "DNR" (do not resuscitate) during a cardiac arrest. A nurse had mistakenly placed a yellow wristband on the patient which, in that hospital, was used to designate "DNR" status. The nurse worked at another hospital in which yellow wristbands were used to identify a "restricted extremity" that should not be used for drawing lab studies or IV access. Luckily the mistake was quickly realized and the patient was rescued.

The survey also found that only one-third of the responding facilities required patients to remove the popular non-medical wristbands often used to show support for charitable endeavors. These colorful bracelets can cause further confusion with color-coded medical bracelets.

While national standards do not exist regarding colors used for med-

continued on page 2, right column

MESSAGE	Purple	Blue	Teal	Green	Red	Pink	Orange	Yellow	White
DNR									
Limited DNR									
Fall Risk									
Restricted Extremity									
Allergy (other than Latex)									
Allergy to Latex									
Tape Allergy									
Procedure Site									
Blood Type/ Blood Bank ID									
No Blood Products									
Outpatient or ER Patient									
Pediatrics/ Mother-Child Match									
Parent/Guardian									
Similar Name									
Observation									
Isolation									
Elopement									
Pacemaker									
Anticoagulants									
Nothing by Mouth (NPO)									
Dietary Restrictions									
Diabetics									

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### check it out! ✓✓✓✓

To reduce confusion when applying colored wristbands to patients:<sup>1</sup>

✓ **Limit choices.** Limit the number of different colors used for patient wristbands. Use only primary and secondary colors and avoid shades of the same color to convey different messages. Also remember that 7% of men and 0.4% of women in the US have red-green color blindness, while blindness to the blue end of the spectrum is much rarer.<sup>2</sup> Designated colors should be used in states that have adopted such standards.

✓ **Use reminders.** Use brief, pre-printed descriptive text on the band to provide clarification (e.g., "allergies" but not a list of specific allergies).

✓ **Remove non-medical bands.** Consider removing colored wristbands that patients may be wearing when they present to the facility. Explain the hazards to patients who refuse, and cover the wristband with a bandage or medical tape if necessary.

✓ **Differentiate colors.** If your facility uses pediatric wristbands that relate to the Broselow color-coding system for pediatric resuscitation carts, take steps to reduce the risk of confusion between the Broselow bands (which are most likely to be used in the emergency department, pediatric units, and neonatal intensive care units) and other color-coded wristbands your facility uses.

**References:** 1) Pennsylvania Patient Safety Authority. Use of color-coded patient wristbands creates unnecessary risk. *Supplementary Advisory*. December 14, 2005; Available: [www.psa.state.pa.us/psa/lib/psa/advisories/v2\\_s2\\_sup\\_advisory\\_dec\\_14\\_2005.pdf](http://www.psa.state.pa.us/psa/lib/psa/advisories/v2_s2_sup_advisory_dec_14_2005.pdf). Accessed June 21, 2007. 2) Howard Hughes Medical Institute. Breaking the code of color: color blindness: more prevalent among males. Available: [www.hhmi.org/senses/b130.html](http://www.hhmi.org/senses/b130.html). Accessed July 27, 2007.

## Mcg vs. mcg/kg

An infant on a high frequency oscillator was receiving fentanyl and VERSED (midazolam) infusions along with bolus doses of both drugs as needed. A high frequency oscillator is a ventilator that provides breathing support to infants in very rapid, shallow bursts of air and oxygen. The "breaths" are so rapid that the chest appears to vibrate. The orders for the *prn* bolus doses appeared on the medication administration record (MAR) as the calculated dose and the volume necessary to administer when removed from a vial. (e.g., the following entry appeared on the MAR: Fentanyl 12 mcg = 0.24 mL IV every 2 hours *prn*.)

The hospital was using Smiths Medical Medfusion 3500 Syringe Pumps with PharmGuard smart pump technology. When a nurse went to administer a bolus dose of fentanyl, she entered the dose as 12 mcg without noticing that the pump actually prompted for a mcg/kg dose. Thus, the 3 kg infant received 36 mcg instead of the intended 12 mcg (4 mcg/kg) dose. Another nurse had double-checked the pump settings before administration and also failed to notice that the pump was prompting for a mcg/kg dose. Additionally, a soft dose-limit alert appeared on the pump, but it was overridden without investigation, and the dose was delivered.

Later that day, when the nurse administered a bolus dose of Versed (midazolam), she again entered the dose listed on the MAR of 0.6 mg. Thus, the infant received 0.6 mg/kg or 1.8 mg,

instead of the desired dose of 0.6 mg (0.2 mg/kg). The soft dose-limit alert displayed again and another nurse double-checked the pump settings, but the alert was overridden, and the drug was administered.

The error was finally uncovered the following day when the same nurse went to administer a bolus dose of fentanyl. She had pressed the pump key that displayed the last dose setting and noticed the error from the previous day. Fortunately, the infant was unharmed.

Mix-ups between total doses, mcg/kg doses, and mcg/kg/minute doses are common. To prevent errors, the dose of a medication should be displayed on the MAR in the same way the information will be needed to program the pump, whenever possible. This requires excellent communication between nurses and pharmacists about whether bolus doses will be delivered via the pump or drawn into a syringe and administered.

Also, smart pump alerts are meant to warn practitioners of impending medication errors and should not be overridden. If an alert is activated, it is crucial for the practitioner to investigate the warning and act accordingly. In this case, these errors could have been averted if the pump alerts had not been overridden and had been analyzed.

### Take our survey on page 3

If you are the initial person who receives this newsletter from ISMP, please complete our readership survey on page 3.

## researchshows...



**Using PDAs to reduce medication errors.** In March 2007, a study linking nurses' use of personal digital assistant (PDA) technology to a reduction in medication errors was published in the *Journal of Nursing*

*Education* (Greenfield S. Medication error reduction and the use of PDA technology.

*J Nurs Educ* 2007;46:127-31). The study was conducted at the Adelphi University School of Nursing in NY. Depending on whether students owned a PDA or not, they were placed in the PDA (experimental) or textbook (control) group, given a case study to read, and then asked to answer questions about medication doses or other clinical decisions based on medication administration. Analysis of the data showed that the PDA group answered the questions with greater accuracy and speed than did the textbook group. The authors concluded that the use of PDAs could more effectively reduce the risk of making medication errors than the use of textbooks.

**Wristbands** continued from page 1  
ical wristbands, several state hospital associations have adopted such standards. For example, the California Hospital Association approved the use purple for "DNR," red for "allergies," and yellow for "fall risk" if color-coded wristbands are used. The Minnesota Hospital Association recommends using the same colors specified above, along with pink for "restricted extremity" and green for "latex allergy." Standard colors have also been recommended in Ohio, Arizona, and New York, with other states considering similar action.

See the recommendations in **Check it out!** (page 1) to be safe when applying colored wristbands to patients.

References can be found under **Check it out!**

## ISMP's List of High-Alert Medications

Based on our recent survey and review by ISMP and other medication safety experts, ISMP's List of High-Alert Medications has been updated (see page 4). Additions to the list include: epoprostenol (Flolan) IV, oxytocin IV, promethazine IV, and sterile water for injection, inhalation, and irrigation (excluding pour bottles) in containers of 100 mL or more. Warfarin, heparin, low-molecular-weight heparin, thrombolytics, and glycoprotein IIb/IIIa inhibitors were moved to a new category, *antithrombotic agents*, to which Factor Xa inhibitors and direct thrombin inhibitors were added. Amiodarone and lidocaine were also moved to a new category, *antiarrhythmics IV*. Nesiritide was removed from the list due to a significant decline in use.

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**Editors:** Judy Smetzer, RN, BSN; Charlotte Huber, RN, MSN; Michael R. Cohen, RPh, MS, ScD; Russell Jenkins, MD. **ISMP, 1800 Byberry Road, Suite 810, Huntingdon Valley, PA 19006.** Tel. 215-947-7797; Fax 215-914-1492; EMAIL: [nursing@ismp.org](mailto:nursing@ismp.org). **Report medication errors to ISMP at 1-800-FAIL-SAF(E).**

## Survey on practice site distribution of the *ISMP Nurse Advise-ERR*®

We need the **help** of **the individual who receives the initial copy of this newsletter at each practice site** to understand how it's received and redistributed within your organization. The survey will take just a few minutes to complete and will give us the information we need to continually increase distribution of medication safety practice recommendations to even more nurses. **We would greatly appreciate just ONE RESPONSE from each hospital/facility BY THE PERSON WHO RECEIVES THE NEWSLETTER INITIALLY, regardless of whether you redistribute it to others.** Please submit your responses by **September 17, 2007**, via our website at: [www.ismp.org/survey/NurseSurvey200708.asp](http://www.ismp.org/survey/NurseSurvey200708.asp) (or by fax to 215-914-1492 only if you do not have Internet access).

**1 As the person who receives the initial copy of the newsletter, what is your professional role? (check one)**

Nurse - **If yes, please note level:**       Staff       Manager       Administrator       Other  
 Pharmacist - **If yes, please note level:**       Staff       Manager       Administrator       Other  
 Physician - **If yes, please note level:**       Staff       Manager       Administrator       Other  
 Educator - **If yes, choose:**       Academic setting       Patient care setting  
 Administrator (other)       Risk/Quality Manager       Patient/Medication Safety Officer       Industry/Regulatory  
 Other (please identify) \_\_\_\_\_       Don't know if I receive the initial copy of the newsletter in my facility

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**2 Do you redistribute the newsletter after it is received? Yes \_\_\_\_\_ No \_\_\_\_\_ If no, skip to question # 6**

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**3 As a general pattern, how do you redistribute the newsletter to others? (check one)**

Send all issues       Send selected issues       Send selected items  
 Other (specify) \_\_\_\_\_

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**4 Please tell us how many people in each category actually receive each issue (or selected items) of the newsletter after re-distribution in your facility. (please give a number for all categories of staff)**

Staff nurses       Educators  
 Nurse managers or administrators       Students  
 Staff pharmacists       Staff physicians  
 Pharmacy managers or administrators       Physician managers or administrators  
 Risk management staff       Respiratory therapists  
 Quality management staff       Others

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**5 Place a checkmark next to each method used to distribute newsletter information. (check all that apply)**

Fax       Email       Internal intranet       Internal website       Bulletin board       Sent with meeting minutes  
 Sent through an internal newsletter       Copied and sent to individuals/departments       Other (specify) \_\_\_\_\_

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**6 Would you be able to download the newsletter if we sent you a link instead of attaching the document to the email message?**  
 Yes \_\_\_\_\_ No \_\_\_\_\_

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**7 What topics would you like to see covered in future editions of the newsletter?** \_\_\_\_\_  
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 \_\_\_\_\_

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**8 Tell us your thoughts about the newsletter by checking the box that best describes your opinion.**

Statements about content	Disagree-----Agree				
	1	2	3	4	5
<b>a</b> The newsletter increases my understanding of the causes and prevention of medication errors.					
<b>b</b> The recommendations for medication error prevention are practical and helpful.					
<b>c</b> The information is relevant to my practice <b>AND/OR</b> to whom I distribute the newsletter.					

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**9 Please describe your organization. (check all that apply)**

Hospital - **please note bed size:**       Below 100 beds       101-200 beds       201-350 beds       351-500 beds       Over 501 beds  
 Outpatient/Community-based provider       Academic setting       Other (specify) \_\_\_\_\_

Please submit responses to ISMP at: [www.ismp.org/survey/NurseSurvey200708.asp](http://www.ismp.org/survey/NurseSurvey200708.asp), or by fax (215-914-1492) by **September 17, 2007**.

Thank you for participating!



# ISMP's List of *High-Alert Medications*

**H**igh-alert medications are drugs that bear a heightened risk of causing significant patient harm when they are used in error. Although mistakes may or may not be more common with these drugs, the consequences of an error are clearly more devastating to patients. We hope you will use this list to determine which medications require special safeguards to reduce the risk of errors. This may include strategies like improving access to information about

these drugs; limiting access to high-alert medications; using auxiliary labels and automated alerts; standardizing the ordering, storage, preparation, and administration of these products; and employing redundancies such as automated or independent double-checks when necessary. (Note: manual independent double-checks are not always the optimal error-reduction strategy and may not be practical for all of the medications on the list).

Classes/Categories of Medications
adrenergic agonists, IV (e.g., epinephrine, phenylephrine, norepinephrine)
adrenergic antagonists, IV (e.g., propranolol, metoprolol, labetalol)
anesthetic agents, general, inhaled and IV (e.g., propofol, ketamine)
antiarrhythmics, IV (e.g., lidocaine, amiodarone)
antithrombotic agents (anticoagulants), including warfarin, low-molecular-weight heparin, IV unfractionated heparin, Factor Xa inhibitors (fondaparinux), direct thrombin inhibitors (e.g., argatroban, lepirudin, bivalirudin), thrombolytics (e.g., alteplase, reteplase, tenecteplase), and glycoprotein IIb/IIIa inhibitors (e.g., eptifibatid)
cardioplegic solutions
chemotherapeutic agents, parenteral and oral
dextrose, hypertonic, 20% or greater
dialysis solutions, peritoneal and hemodialysis
epidural or intrathecal medications
hypoglycemics, oral
inotropic medications, IV (e.g., digoxin, milrinone)
liposomal forms of drugs (e.g., liposomal amphotericin B)
moderate sedation agents, IV (e.g., midazolam)
moderate sedation agents, oral, for children (e.g., chloral hydrate)
narcotics/opiates, IV, transdermal, and oral (including liquid concentrates, immediate and sustained-release formulations)
neuromuscular blocking agents (e.g., succinylcholine, rocuronium, vecuronium)
radiocontrast agents, IV
total parenteral nutrition solutions

Specific Medications
colchicine injection
epoprostenol (Flolan), IV
insulin, subcutaneous and IV
magnesium sulfate injection
methotrexate, oral, non-oncologic use
oxytocin, IV
nitroprusside sodium for injection
potassium chloride for injection concentrate
potassium phosphates injection
promethazine, IV
sodium chloride for injection, hypertonic (greater than 0.9% concentration)
sterile water for injection, inhalation, and irrigation (excluding pour bottles) in containers of 100 mL or more

Background
Based on error reports submitted to the USP-ISMP Medication Errors Reporting Program, reports of harmful errors in the literature, and input from practitioners and safety experts, ISMP created and periodically updates a list of potential high-alert medications. During February-April 2007, 770 practitioners responded to an ISMP survey designed to identify which of these medications were most frequently considered high-alert drugs by individuals and organizations. Further, to assure relevance and completeness, the clinical staff at ISMP, members of our advisory board, and safety experts throughout the US were asked to review the potential list. This list of drugs and drug categories reflects the collective thinking of all who provided input.

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