Spectrum of Problems with Using Color
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INTRODUCTION
A color-coding system for the pharmaco logical class of ophthalmic medications, along with similar corporate logos, fonts, and package sizes, has led to numerous errors with these products. Anti-infective agents are tan, steroids are pink, mydriatic and cycloplegic agents are red, beta blockers are yellow, and so on. However, individual products and dosage strengths within each drug class are not color-coded, and mix-ups have been widely reported within each class.

To present some of the complexities associated with the use of color, this article explores the differences between color coding, color differentiation, and color matching and explains how end-users and manufacturers customarily apply each technique.

THE USE OF COLOR

Color coding is the systematic, standard application of color to aid in classification and identification. A color-coding system allows people to memorize a color and match it to its function. For example, a black cap is used in the U.S. for all vials of potassium chloride concentrate; black caps cannot be used for any other products. Thus, practitioners can assume that a manufacturer’s vial with a black cap contains potassium chloride concentrate as long as the practitioners have memorized the fact that the color black means potassium chloride.

Color differentiation, by contrast, entails the use of color to make certain features stand out or to help distinguish one item from another. The color itself is not a standard code that is applied systematically to classify and identify the product, as with color coding.

Color matching is also sometimes used to reduce the risk of errors. For instance, a medical device might have a blue plug that attaches to a blue receptacle and a yellow plug that attaches to a yellow receptacle. However, the colors have no special meaning beyond their matching one item with another.

PROBLEMS WITH COLOR

Color Coding: Frequently Occurring Problems
Color coding for pharmaceutical products should be used with extreme caution, because several problems are associated with the widespread adoption of this practice. For one, there is a limit to the variety of discernible colors available for commercial use. In other industries, color-coding research has shown that subtle distinctions in color are poorly discernible unless products are adjacent to each other.1,2

Contrast with background colors or surrounding colors also can be problematic if a certain color must be used for product identification. Of course, if a clinician is color-blind, color-coded products might be misidentified. This type of error could be the reason why the Food and Drug Administration (FDA) and the pharmaceutical industry have frowned on color-coding systems for the most part.

In addition, color coding has not been scientifically tested as a way of preventing medication errors. Like any change, though, there is evidence that it might actually contribute to some errors that would not happen without it. As mentioned earlier, color coding of ophthalmic products according to pharmacological category has led to numerous errors.

Another example is the recent change in the colors used to identify needle gauges on disposable syringes. Several overdoses of insulin have been reported at a rate of 10 times the correct dose, because the 25-gauge needles on some tuberculin syringes are now coded in orange, a color that was previously associated with insulin syringes.

Color coding can also result in errors if the coding is not applied consistently throughout the industry or within a single manufacturer’s product line. For example, one company used product-specific color-coding schemes for the labels on some of its products and yellow and blue labeling for the remainder of its products. On occasion, practitioners have mixed up some of the products with blue and yellow labels without recognizing that the blue and yellow labels were not color-coded to a specific product.

Color Differentiation: Fewer Problems
Although it has not been scientifically verified that color differentiation prevents medication errors, practitioners favor it in commercial use to help reduce the risk of product-selection errors within a manufacturer’s product line. The idea behind this practice is to make it more efficient for users to find and select medications from storage areas, then to carefully read the labels for verification. However, users of the products don’t always read the labels, or they might be affected by confirmation bias and might not see that they do not have the correct product in their hands.

However, color differentiation has been used successfully in commercial applications to enhance the recognition of various label elements by making the information stand out. For example, a product warning in red is more likely to be seen if the product’s primary label is black and white.

At the Institute for Safe Medication Practices (ISMP), we have also suggested using a yellow highlighter to draw attention to important label information, such as the concentration of the drug or the total volume of product in the vial.

Color Matching: Occasional Problems
In a similar fashion, there is little scientific evidence to prove the value of color matching.

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matching as related to medication use or pharmacological products. In fact, color matching is rarely, if ever, used for such purposes. However, if users and manufacturers apply the proper colors to their products, the benefits of color matching appear sound when the technique is used for medical devices.

SOLUTIONS FOR IMPROVING SAFETY

Of course, if all products had identical black and white labels and were packaged in the same size and shape, careful reading of the labels would be the only way to differentiate them. Perhaps this would reduce the potential for errors, but it is not likely to happen in our free enterprise system of marketing pharmaceuticals.

We at ISMP look forward to the time when all products will be bar-coded or identified through radiofrequency identification (RFID) methods. At that point, we will be better able to store all products together while telling each drug apart, even if we misread or misunderstand the label.

REFERENCES


The reports described in this column were received through the USP–ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP (www.ismp.org) or the USP (www.usp.org) Web site or communicated directly to ISMP by calling 1-800-FAIL SAFE or via e-mail at ismpinfo@ismp.org.