



A misplaced label may cause erroneous test results.

Reading Between the Lines

A qualified job applicant is denied employment because of an erroneous drug screening. An emergency room patient is left waiting while blood tests are repeated. A male patient tests positive for pregnancy.

All these situations can be the result of simple errors that can arise when working with bar-code technology.

Productive, But Not Perfect

Bar-code technology, which became a standard practice in many clinical labs during the last decade, remains a highly accurate and inexpensive way to identify patient specimens as unique entities. It not only aids information transfers and enhances productivity, but it's also a basic building block of

laboratory automation.

As accurate as it is, however, bar-code technology is not immune to error. All bar-code reading systems, whether they're found in a lab or a local grocery store, have an error rate that is typically reported as a handful out of multiple millions.

In the clinical lab environment, the error rate is higher because bar-code labels vary greatly in symbology, print quality and physical placement on the sample tubes. Of primary concern to most laboratories is the error rate of misreads—a sample identification that is mistaken for another sample ID.

The good news is that laboratories can take steps to reduce the incidence of bar-code errors—thanks to the advent of some simple industry guidelines.

Common Ground

In recent years, the National Committee for Clinical Laboratory Standards (NCCLS), a global organization that promotes the development and use of standards and guidelines within the healthcare community, established bar-code reader and printing standards that can help meet current and future clinical laboratory needs for consistency, connectivity and automation.

As automation becomes more prevalent in the clinical laboratory environment, standards for bar-coding are expected to increase in importance and acceptance. Currently, the NCCLS Auto2-A is the applicable standard for specimen ID labeling and automation in the clinical lab. Of these standards, several important aspects are within the control of the lab:

- Label Quality and Placement
- Symbol Printing Considerations
- Symbology Options

The choices laboratories make about these bar-code variables can influence the quality of the bar-code labeling process—and ultimately the error rate associated with bar-code technology in general.

Label Quality & Placement

High quality bar codes and labels are essential for accurate bar-code reading. In fact, labels that are improperly printed or applied are a major cause of bar-code reading errors. To maintain the highest possible accuracy and quality, keep these best practices in mind:

- Print sample ID bar-code labels of quality "B" or better (as per the ANSI Standard: X3.182-1990 Bar Code Print Quality Guidelines). Specifically, use matte labels, which should be printed using sharp, high-contrast printing with no smudging or smearing.
- Apply bar-code labels to tubes within the specifications (as provided by the instrument manufacturer) for label placement and make sure the label is oriented within a few degrees of vertical on the tube.

To help ensure that labels can be read by the instrument's bar-code scanner, place the labels within the read zone, which varies by instrument. And, if your lab is like most, you're probably running the same tube on multiple instruments. It may be necessary to adjust the symbol placement on your sample tubes so that the labels can be properly read by all your lab's instruments.

Symbol Printing Considerations

When it comes to symbol printing, there's a lot to consider. For starters, the details of the bar-code symbol itself are just as important as the printing quality and label placement. If the symbol deviates significantly from defined tolerances, the bar code becomes more difficult—and sometimes even impossible—to read. That's why it's important to remember the following tolerances:

- The narrow element width should be 10 mil (that's a thousandth of an inch) or more. Bar codes of less than 10 mil narrow element width are more difficult to read.
- Quiet zones must be a minimum of 3.5 mm.
- Symbols that are at least 10 mm in height provide a wider area in which to read the label if it is tilted from vertical.

Symbology Options

Laboratories also can choose their preferred bar-code symbology for bar-code identification as well as the configuration options available with that symbology. Currently, the four major symbologies for sample identification in the laboratory are:

- Code 128 (recommended by NCCLS and Beckman Coulter)
- Code 39
- Codabar (NW7)
- Interleaved 2 of 5

The NCCLS specifies Code 128 as the preferred symbology for use with laboratory automation systems. This symbology not only offers the advantages of accuracy and compact size, it also includes an inherent check character, is read bidirectionally, and allows numeric characters as well as both upper and lower case alphabetic characters.

The NCCLS recommends that any laboratories using Code 39, Codabar (NW7) and Interleaved 2 of 5 should replace their bar-code symbology with Code 128 by December 31, 2003.

To maximize bar-code reading accuracy and to reduce the chances of misread sample IDs, when using codes other than code 128, Beckman Coulter also recommends:

- The use of a check digit to help provide a substantial increase in accuracy and decrease in errors;
- Avoiding or limiting the use of less accurate symbologies, including Interleaved 2 of 5 and Codabar; and
- The use of a fixed length code, which provides the bar-code reading system with an additional check of the bar-code reading accuracy.

The Right Choice to Make

The choices each laboratory makes about bar-code options can have a significant impact on bar-code error rates. Regulatory organizations and instrument manufacturers are doing their part to standardize bar-code technology.

But, as of today, laboratories still have a much higher degree of control.

By making sure your laboratory is utilizing these bar-coding best practices, you can help protect your organization and patients from the potentially dangerous perils of bar-code blunders. And remember: The Beckman Coulter service support team is here to help your lab incorporate these and other best practices to ensure the delivery of more accurate and timely test results.

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