ARUP LABORATORIES

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CHARTING REFERENCE INTERVALS AND FLAGGING ABNORMAL RESULTS

Components of a Laboratory Test Result
A laboratory test result, has several components:

- The result itself, which may be numbers (numeric), words (alphabetic), or both (alphanumeric)
- A reference interval, as applicable
- A flag, as applicable (available flags include H [high], L [low], A [abnormal], and C [critical])
- Additional interpretive comments and/or footnotes, as applicable

Establishing Reference Intervals
ARUP uses a laboratory information system (LIS) to manage test results. Like most other laboratory information systems, ARUP's LIS has functional limitations that do not allow multiple gradations in reference interval reporting that would distinguish equivocal from positive results. Additionally, there is no mechanism for reference intervals to be customized for an individual client.

For tests such as serum sodium, for which a reference interval is applicable, ARUP's LIS uses the reference interval function. The reference interval automatically appears next to the test result in ARUP Connect™.

For many tests, however, the use of a traditional reference interval would oversimplify the test results and mislead physicians and other care providers. In such cases, ARUP's medical directors often choose to present interpretive information in the form of a textual footnote comment attached to the result rather than rely on the reference interval function in ARUP's LIS.

Mechanisms for Setting High/Low Flags
When a test is defined in ARUP's LIS with a numeric result type, and if a reference interval has been defined in the LIS for that test, then the high/low flags will automatically appear for each test result based on that reference interval.

A numeric result that is greater than the upper end of the reference interval will automatically flag as "H" and a numeric result that is less than the lower end will automatically flag as "L." A numeric result that ARUP has defined as a critical value will automatically flag as "C."

Tests with a numeric result type for which no reference interval is defined in the LIS do not trigger any flags regardless of the result. Tests set up with an alphanumeric result type are flagged according to rules defined in the LIS

by ARUP. For example, ARUP might flag a test result of positive as either abnormal or critical.

Complexities in Flagging Test Results
Use of a single reference interval that categorizes results as high, low, or critical works well for tests such as serum sodium where the interpretation is best made in comparison to results in a healthy population. For other tests, especially highly esoteric ones, these traditional concepts do not apply cleanly, and flagging results in this fashion can be misleading.

The following example demonstrates the oversimplification and misinformation that could occur if traditional reference intervals were used:

Compliant or illicit use of opiates
Opiate testing is ordered in two major clinical settings, both of which are very common in pain clinics. For patients who have been prescribed opiates, the test is used to verify that the patient is taking the drug and thus presumably not diverting the drug into the black market. For such patients, it would seem reasonable to flag negative results as low and not flag positive results. On the other hand, for patients not prescribed opiates, the test is used to detect illicit opiate use. In this setting, it would seem reasonable to flag positive results as high and not flag negative results.

Limitations of Charting Systems
ARUP clients may issue laboratory results to their physicians in the form of paper charts. A few of these charting systems display the results in the form of normal and abnormal columns. In order to determine in which column to place a result, these systems typically look for the presence of a flag (H, L, C, or A); all flagged results display in the abnormal column, and everything else in the normal column.

Knowing whether a result is normal or abnormal for a given patient depends on clinical context. Making that designation on a chart based simply on the existence of a flag or footnote is simplistic and at times misleading to the clinician. It is critical that physicians review all test results, not just the results that a laboratory has labeled with an abnormal flag. As illustrated in the example above, it is not always possible for ARUP Laboratories to define reference ranges and flag settings in our LIS in ways that satisfy all the major clinical settings in which a test is used. ARUP does not recommend the practice of charting results in normal and abnormal columns.