The purpose of this System Brief is to discuss some of the important points in running a performance evaluation between the Alere Cholestech LDX® System and your current method and interpreting the results. The goal of a performance evaluation should be to give you confidence in the accuracy and precision of your Alere Cholestech LDX® System. The quality of the results also depends on a number of pre-analytical factors, which will be discussed in this bulletin. If you would like help with an evaluation, contact the Alere™ Product Support Care Center. Alere™ Product Support has a protocol that can assist you in evaluating the performance of your Alere Cholestech LDX® System.

### What is Accuracy?

Accuracy is how close a result is to the “true” value. Using a target as an example, accuracy is how close your shot is to the center of the bull’s eye. The three shots on the target are close to the center but a little biased to the right. “Bias” is a word used to describe or indicate how far you are from the “true” value or the bull’s eye. For comparison purposes the “true” value may be a well standardized reference method or the result you get from the method you currently use.

### What is Precision?

Precision is reproducibility or how closely several results analyzed on the same sample agree. Using the example of the bull’s eye, the first target has three shots that are close together, or very precise. The second target has three shots that are scattered around the center. These are not precise. If you average all of the shots, the accuracy would be right on the bull’s eye. But if you are only going to make one measurement you want that one measurement to be accurate. Without good precision you will not always have accurate results.

See the System Brief on Accuracy and Precision for a further discussion of accuracy and precision.

### Factors to Consider Before Running an Evaluation

#### Sample Type

Whenever possible it is best to compare the same sample type on the Alere Cholestech LDX® System and your current method, i.e. serum vs serum or whole blood vs whole blood. This will eliminate the variability caused by collection methods and sample types. Acceptable sample types for the Alere Cholestech LDX® System may include fingerstick whole blood, lithium or sodium heparin whole blood (green top tube), plasma, and serum. Refer to the package insert that accompanies each box of Alere Cholestech LDX® cassettes to determine the appropriate sample type for that cassette.

**Note:** Any sample type may be used for evaluating the Alere Cholestech LDX® System. However, for routine use, the Alere Cholestech LDX® System is CLIA waived for fingerstick or venous whole blood unprocessed samples only.

#### Blood Collection Technique

Consult your Alere Cholestech LDX® System User Manual for the proper fingerstick technique. Excessive squeezing of the finger will affect all test results. Leaving the tourniquet on too long during the venipuncture has been shown to elevate lipids as much as 5%.

#### Timing

The samples to be run on the Alere Cholestech LDX® System and the comparison method should be drawn at the same time and in the same location.

#### Sample Handling

Venous samples should be well mixed, inverted gently 7-8 times and tested on the Alere Cholestech LDX® System within 30 minutes of collection. Fingerstick samples should be run rapidly after collection. Refer to the package insert that accompanies each box of Alere Cholestech LDX® cassettes to determine how long samples can remain in the capillary tube. Samples should be run on the reference or comparison method on the same day they are collected. Delay in running the samples will add more variability to the results. If using stored serum samples, they should be collected...
and stored according to the instructions in 
the package inserts that accompany both 
the Alere Cholestech LDX® cassettes and 
the comparison method reagents.

**Glucose**

When evaluating glucose results on 
fingerstick samples, keep in mind that 
capillary blood glucose levels on non- 
fasting individuals may be 20 to 70 mg/ 
dL greater than venous levels drawn at the 
same time.¹

After the sample is placed into the 
cassette well, **immediately** place the 
cassette into the drawer and push the 
RUN button.

**Training**

Read the Alere Cholestech LDX® 
System User Manual and watch the 
Alere Cholestech LDX® System Training 
Video before running your evaluation. 
Alere Technical Service can answer any 
questions you have before you begin your 
evaluation.

**Quality Control**

Run the optics check cassette and quality 
control material before running patient 
samples. Ensure that all results are within 
established ranges before running patient 
samples.

**How Many Samples Should 
Be Tested in an Evaluation?**

Your confidence in the results will increase 
with the number of samples you run. Alere 
recommends that you run at least 20 
samples. With n = 20 samples you will have 
a reasonable degree of confidence that the 
results of the evaluation are an accurate 
indication of the true performance of the 
Alere Cholestech LDX® System. You can 
run fewer samples but your confidence in 
the results will not be as high. The samples 
should also cover the measuring range for 
each analyte.

**How Do We Look At the 
Results?**

The quality of a result from any test method 
depends on the accuracy and precision of 
the method. The difference between two 
methods may be expressed in terms of 
total error (TE), which takes into account 
both accuracy and precision. The National 
Cholesterol Education Program (NCEP) 
has established total error goals for lipid 
tests that can be used to determine 
whether any differences between routine 
lipid methods and the Centers for Disease 
Control and Prevention (CDC) reference 
methods are acceptable.² These NCEP TE 
goals are shown in Table 1.

This means that you can expect 95% (95 
out of 100) of the test results in normal 
individuals to be within these total error 
goals when you compare the results from a 
routine lipid method to the CDC reference 
method for that analyte. The NCEP goals 
apply to all testing methods regardless of 
instrument size or location.

There are challenges in interpreting lipid 
method comparison data when neither 
method is a CDC reference method. 
For example, consider two methods, A 
your current method) and B (the Alere 
Cholestech LDX® System). Assume that 
total precision is identical between the 
two. Method A is compared with a CDC 
reference method and found to have a 
negative bias, but overall an acceptable 
total error. Method B is compared with a 
CDC reference method and found to have a 
positive bias, but overall an acceptable 
total error. However, it is possible that 
when A and B are compared with each 
other, and method A is considered the 
“reference,” the total error for method B will 
exceed total error limits because Method 
A has a negative bias and Method B has a 
positive bias compared to the CDC 
reference method.

**Looking at a Typical 
Set of Results**

(See the Table 2 for an example.)

Place the results in a spreadsheet and 
calculate the % Bias between the two 
results as follows:

- Is there the same number of results for 
both methods? If not, delete the missing 
results from both data sets.
- Are all results within the testing range 
of both methods? If not, eliminate those 
results from both data sets.
- Are the results acceptable? Look at the 
% Bias column. For total cholesterol 
(TC) 19 of the 20 results are within the 
total error goals, ≤8.9%. 95% of the 
results should be ≤8.9%, or 1 in 20 may 
be >8.9%. The total cholesterol results 
fulfill these criteria and the mean 
bias of –0.9% is also acceptable.

For HDL cholesterol (HDL) 19 of the 20 
results are within the total error goals, 
<13%. The 1 result out of 20 that is 
>13% is acceptable. The mean bias of 
5.2% is also acceptable.

**Conclusion:** This evaluation is acceptable 
for both total cholesterol and HDL 
cholesterol.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>NCEP TE</th>
<th>CLIA PT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>≤ 8.9%</td>
<td>± 10%</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>≤ 13%</td>
<td>± 30%</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>≤ 15%</td>
<td>± 25%</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>≤ 12%</td>
<td>NA</td>
</tr>
</tbody>
</table>

Although there is not a nationally 
recognized TE goal for glucose, the Alere 
Cholestech LDX® System provides results 
that are consistent with good patient 
care, meeting a total error of ≤12%.
Standardization of Lipid Tests

Calibration or standardization differences between methods can also play a role in the agreement in results between the Alere Cholestech LDX® System and your current method.

In order to achieve the lipid performance goals established by the NCEP, the CDC has developed definitive methods for measuring total, HDL & LDL cholesterol and triglycerides. These methods are the established accuracy base for lipid measurement.

The goal of lipid standardization is for the results of tests conducted in clinical laboratories to be traceable to the CDC methods. The CDC administers two programs to support lipid standardization. The Cholesterol Reference Method Laboratory Network (CRMLN) assists manufacturers in certifying that their lipid reagents meet NCEP performance goals and are traceable to CDC methods. CRMLN certification is biennial and is available for total, HDL, and directly measured LDL cholesterol. The Lipid Standardization Program (LSP) provides quarterly certification for total & HDL cholesterol and triglycerides primarily for laboratories involved in epidemiologic research and clinical trials.

Alere Cholestech LDX® lipids are CRMLN certified as traceable to CDC methods for total & HDL cholesterol, and LSP certified for total & HDL cholesterol and triglycerides.

Other Statistical Methods

A common statistical test used to evaluate agreement between methods as calculation of the slope, intercept is linear regression. This test utilizes additional statistical parameters such as correlation coefficient. This test is useful but only under certain conditions:

- The number of samples must be large, ideally 40 or more.
- The range of results for each analyte should be wide, i.e. 150–400 mg/dL for total cholesterol or 15–90 mg/dL for HDL. This requirement is often difficult to meet.
- Linear regression may be invalid if there are outlying points at the upper or lower end of the sample range that do not agree.

If you are interested in performing linear regression on your data, contact the Alere™ Product Support Care Center and we will be glad to help you with the calculation and interpretation of the results.

References
