

Sample Stability: Transport and Storage

Stability has been defined by the International Standards Organization (ISO) as the capability of a sample material to retain the initial property of a measured constituent for a period of time within specified limits when the sample is stored under defined conditions. Instability occurs when there are important changes in one or more of those measurements.

Even before a collection tube is filled with blood, the empty tubes must be stored according to manufacturers' instructions. Failure to comply with these can influence the stability of the blood sample that is subsequently collected into that tube.

It is important to keep in mind that sample transport and storage conditions, together with the time interval between collection and testing, can have an important effect on the quality of test results.

Despite increased point-of-care testing in many areas of laboratory medicine, the vast majority of specimens are collected in one place and transported to another for analysis. Some tests are available only in certain reference centers, requiring samples to be transported over long distances.

In many countries, testing is increasingly consolidated in fewer but larger laboratory facilities with more and more centralization of the laboratory service. This centralization has increased the focus on controlling variabilities in the sample transport and storage aspects of the preanalytical phase. Consideration of the effects of sample transport and storage and requiring evidence of sample stability are particularly important, since this pivotal aspect of lab testing is not normally assessed by proficiency testing programs.

Sample stability may also depend on the tube type used for blood collection (including any separation gels, anticoagulants and other additives present), the temperature of storage prior to testing, and the laboratory method used for determination. This is particularly true in relation to hemostasis.

The mode of transporting samples to the laboratory may be relevant as well. Rapid sample delivery via pneumatic tube transportation is attractive for reducing transport times and is an acceptable method of sample transport for some types of laboratory tests. However, for blood gas measurements, some pneumatic transfer systems may be unsuitable. It is also essential that any air bubbles are eliminated from the collection device upon collection and prior to transport, as this may result in an altered PO₂ measurement.

For some lab tests, samples may be stored in the laboratory prior to analysis, when tests are performed in batches for efficiency reasons or when a test is added after completion of the original analysis. Such storage conditions may critically affect the results obtained, and findings based on one set of study conditions cannot always be safely extrapolated to other conditions. Further, storage temperature options, such as refrigeration or deep-freezing, may induce changes in test results.

Laboratories should control these important preanalytical variables and use only validated approaches to these aspects of the preanalytical phase.

Resources:

- CLSI document H21-A5. Collection, Transport, and Processing of Blood Specimens for Testing Plasma-Based Coagulation Assays and Molecular Hemostasis Assays; Approved Guideline - Fifth Edition (ISBN 1-56238-657-3). Clinical and Laboratory Standards Institute, 940 West Valley Road, Suite 1400, Wayne, PA 19087; 2008.
- International Standard Organization document ISO 15189: 2007. Medical laboratories - Particular requirements for quality and competence.
- Quality and reliability of routine coagulation testing: can we trust that sample? Lippi G, Franchini M, Montagna M, Salvagno GL, Poli G, Guidi GC. Blood Coag Fibrinol 2006; 17:513-519.
- Preanalytical considerations in blood gas testing. Baird G. Biochem Med 2012;23:19-27.
- Effects of air bubbles and tube transportation on blood oxygen tension in arterial blood gas analysis. Lu JY, Kao JT, Chen TI, Lee TF. J Formos Med Assoc 2002;102:246-249.