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Understanding Objective Evidence: (What It Is and What It Definitely Is Not)

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- Learn what common industry practices don't result in objective evidence
- Review business, scientific and legal definitions of objective evidence
- Understand the basic concepts behind the scientific method
- Review test protocols to ensure they result in true objective evidence
- Examine FDA expectations for objective evidence

As you likely know, computer system validation requires **objective evidence** – evidence that proves the results of a particular system will be consistent throughout its operating lifetime. But do you really understand what constitutes objective evidence – from a scientific and a legal perspective, and of great importance to those subject to regulatory inspections, from the perspective of the U.S. Food and Drug Administration (FDA)?

What Objective Evidence is NOT

Let's answer the question by first understanding what objective evidence is not. **The words "pass", "fail", "yes", "no", "as expected", "true" and "false" are not and never will be objective evidence.** They are ***conclusions***. Conclusions are what you make based on what you believe the objective evidence shows.

Instead, **objective evidence is what you observed, what actually happened, or what did not happen**. In science, we document objective data – as well as test methods – so that others can perform the same tests and compare their results (objective evidence) to ours. ***That's the essence of objective evidence***. With this approach, others can objectively determine whether our conclusions are valid.

Useful Definitions from Different Perspectives

It may be helpful to see how different disciplines approach the concept of objective evidence. Here are some example definitions of objective evidence from various literature sources and perspectives:

• **From a business perspective**: Objective evidence is "information based on facts that can be proved through analysis, measurement, observation, and other such means of research."

• **From a legal perspective**: Objective evidence is "real evidence, also known as demonstrative or objective evidence; this is naturally the most direct evidence."

• **From a scientific perspective**: "To be termed scientific, a method of inquiry must be based on gathering observable, empirical, and measurable evidence subject to specific principles of reasoning. A scientific method consists of the collection of data through observation and experimentation, and the formulation and testing of hypotheses."

• **From a list of Plain English definitions related to the ISO 9000, 9001 and 9004**: Objective evidence is "data that show or prove that something exists or is true. Objective evidence can be collected by performing observations, measurements, tests, or by using any other suitable method."

Basic Expectations of the Scientific Method

In science, we know procedures will vary from one field of inquiry to another. There are, however, identifiable features that distinguish scientific inquiry from other methods of knowledge. Scientists propose hypotheses as explanations of phenomena, then design experiments to test those hypotheses. **The methods scientists use must be repeatable so that someone else, using the same methods, can dependably predict future results**. Theories may encompass wider ranges of inquiry and may combine many hypotheses together in a coherent, supportive whole. This consolidation in turn may help other scientists form new hypotheses or place groups of hypotheses into context.

The processes used in scientific inquiry must be objective to reduce and preferably eliminate biased interpretations of the results. Another basic expectation of the

scientific process is that you always document results, maintain the supporting data, and share all data and methodology – thus allowing careful scrutiny by other scientists. As a result, other scientists have the opportunity to verify results by attempting to reproduce them. This practice is known as "full disclosure" and allows scientists to establish statistical measures of the data's reliability.
The scientific method can never absolutely prove the truth of any hypothesis. It can only falsify the hypothesis. That's what Einstein meant when he said, "No amount of experimentation can ever prove me right; a single experiment can prove me wrong."

Review Your Test Protocols for Bias

It's human nature to try to prove our own hypotheses are correct. But our beliefs can alter our observations. We're prone to what's known as "**the human confirmation bias**." This bias is called a heuristic* – something that leads persons with a particular belief to see things as reinforcing that belief, even if another observer would disagree.

(*A heuristic is a rule of thumb, an educated guess, an intuitive judgment, or simply common sense. A heuristic is a general way of solving a problem.)

To help eliminate this natural bias, science demands we test hypotheses by attempting to disprove them. This approach isn't always practical in industries regulated by the FDA, but we still should try to remove all bias from our validation efforts. A typical hypothesis for a computer system validation is "My installed system for [whatever the function] will consistently, reliably, and reproducibly produce data or perform as described in the requirements, given the defined hardware, software, procedures, and personnel." Our validation protocols likely are written to help prove the validity of this statement.

But the way we write those protocols will determine how much and what kind of objective data we get. **Providing the expected results up front (beforehand) to the tester is not the optimum method to obtain true objective evidence**. Yes, we as validation professionals need to know the expected results (acceptance criteria), but remember it's the reviewer of the objective evidence – not the tester – who must know those criteria. Otherwise, the human confirmation bias of the tester may prevail and dilute your confidence in the objectivity of test results.

Review Your Test Protocols for Efficiency

Often protocols are written to provide objective data at each step in the protocol. Because of this, we often see protocols that look like those in the Table below:

Table 1: Validation Protocols

Step #	Process Step	Expected Result	Actual Result	Pass/Fail
1.	Turn on computer	Turns on	As expected	Pass
2.	Log-in	Allows log-in	As expected	Pass
3.	Main menu displays	Main menu displays	As expected	Pass

In this example, what matters is that the Main menu displays after the appropriate log-in. The fact that the system will turn on and allow the tester to log-in is supported by the fact that the Main menu displays. Obviously, the Main menu won't display if the computer doesn't boot up and allow the tester to log-in. So in this case, the objective data only need to be obtained at Step #3. A screen print at that point provides objective data that shows Steps #1 through #3 have been executed correctly.

Of course, there may be multiple steps in any given test protocol. But you may find data generated or displayed at those various steps proves a wider portion of the system is performing as designed. So you can be more efficient in developing objective evidence by documenting only the data that truly reflects the system will function as designed or intended.

FDA Requirements for Objective Evidence

FDA is a science-based law enforcement agency and, therefore, requires answers that are scientifically and legally supported. FDA expects your objective data to answer the following questions:

- **Scientific** – Can the data be ***evaluated by independent observers*** to reach the same conclusions?
- **Scientific** – Are the data documented in a manner that ***allows re-creation of the data*** or the events described?
- **Scientific** – Does the documented evidence provide ***sufficient data*** to prove what happened, when, by whom, how, and why?

- **Legal** – Was the documentation ***completed concurrently*** with the tasks?
- **Legal** – Is the documentation ***attributable*** (directly traceable to a person)?
- **Legal** – Have the data and associated documentation been maintained in a manner that ***provides traceable evidence*** of changes, deletions, additions, substitutions, or alterations?
- **Legal** – Are the data and associated documentation maintained in a manner that ***protects and secures*** them from changes, deletions, additions, substitutions, or alterations?

Additional FDA Expectations

FDA also expects you to follow good documentation practices. That means your data must be clear, legible, indelible, and documented concurrently. FDA expects your documents and records to be complete, dated, signed, reviewed, and approved (if applicable). Furthermore, the Agency expects you to maintain regulated documents and records in formal, approved document management systems.

FDA investigators will look for evidence of data changes. So you should note any written changes using a single cross-out, with appropriate date and initials. If your data is in electronic format, FDA will look for a clear audit trail traceable from all fields. For good laboratory practices, FDA also will expect you to include the reason(s) for any change.

Trust is the Ultimate Objective of Objective Evidence

To satisfy FDA, start with a clear definition of how your company will establish and review objective evidence in all of its testing procedures. Make sure your objective evidence is based on what actually happened – including what the tester actually observed – during testing. Avoid subjective conclusions such as “Yes/No” and “Pass/Fail” and try to minimize the opportunity for human confirmation bias.

Develop and apply a scientific-based approach to your validation efforts to ensure consistent results. In addition, satisfy the legal expectations for objective evidence by establishing and maintaining a trail of data integrity throughout all your regulated systems and throughout their lifecycles.

In the end, **the goal is trust** – trust in your validation efforts by your system users, by your customers, and of course by the FDA. With scientifically and legally sound objective evidence, you’ll be confident others will be able to trust your data,

its origins and documentation, and the ultimate results of your systems.

Do have questions or feedback about this Advisory? Email us at Info@EduQuest.net.

About the Author

Denise Dion is the Vice President of Regulatory and Quality Services with EduQuest, a global team of FDA compliance experts headquartered near Washington, DC. She spent 18 years of her career with the FDA, where she served as an Office of Regulatory Affairs (ORA) headquarters' authority on agency-wide inspections and investigations. She developed many of FDA's inspection guidance and training materials, including serving as the primary editor of the ***Investigations Operations Manual (IOM)***. She also was one of the authors and trainers of FDA's Quality System Inspection Technique (QSIT).

For her EduQuest clients, Denise provides regulatory guidance and regularly conducts facility audits to assess compliance with drug, medical device and biologics regulations. She also develops and delivers inspection preparedness training. She is a lead instructor for four of EduQuest's most popular training courses:

- **Quality Systems Regulation Compliance Basics**
- **Design Control for Medical Devices: Meeting FDA's 21 CFR 820.30 Rules for Quality Design and Manufacturing**

- **The CAPA Clinic: Effective CAPA Systems and Failure Investigations**
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